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**ANALYSIS OF ALTERNATIVES (AoA) PROCESS
IMPROVEMENT STUDY**

DECEMBER 2016



**CENTER FOR ARMY ANALYSIS
6001 GOETHALS ROAD
FORT BELVOIR, VA 22060-5230**

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Director
Center for Army Analysis
ATTN: CSCA-RA
6001 Goethals Road
Fort Belvoir, VA 22060-5230

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ANALYSIS OF ALTERNATIVES (AOA) PROCESS IMPROVEMENT STUDY

SUMMARY

THE PROJECT PURPOSE was to develop an approach to focus AoA activities to most efficiently and effectively deliver results that meet decision-maker needs.

THE PROJECT SPONSOR was the Deputy Chief of Staff, G-8.

THE PROJECT OBJECTIVES were to:

- (1) Lay out all the analysis-related AoA process activities (including pre- and post-AoA activities).
- (2) Identify issues in the current AoA process.
- (3) Identify potential solutions to issues, as well as the organizations with the authority to enact the solutions.
- (4) Lay out the various decision makers who use AoAs and supporting analyses, their needs, and the potential consequence of meeting or failing to meet their needs.

THE SCOPE OF THE PROJECT includes:

- (1) "As Is" process mapping. What are the inputs, outputs, timelines, and responsibilities for each step of the process? What constraints are there to the "As Is" process?
- (2) "To Be" process improvement and layout. What changes are needed? Who can affect the changes? What are the expected time saves/cost/risk of any changes?
- (3) Utilization of case studies for both "good" and "challenged" AoAs to identify lessons learned. What does "right" look like? What problems were encountered in recent AoAs? How do we eliminate, mitigate, or solve these?
- (4) Utilization of U.S. Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC's) AoA Primer and previous acquisition reviews (Decker-Wagner, etc.).
- (5) Utilization of interviews.

THE PRINCIPAL FINDINGS are:

- (1) The AoA is burdened by "immature" Initial Capabilities Documents (ICD). The AoA must then refine and prioritize capability gaps, requirements, and concepts of employment.
- (2) Army leadership does not inform the scope of the AoA.
- (3) For developmental systems, the Army must develop data, scenarios, and models and simulations (M&S) to support analyses. These items have very long lead times.
- (4) Staff friction, sequential reviews, and mission creep cause delays.

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THE PRINCIPAL RECOMMENDATIONS are:

- (1) TRADOC ensures a Capabilities-Based Assessment (CBA) is conducted to standard by those that developed the requirements and capabilities.
- (2) Use existing processes to prioritize gaps (e.g., Capability Portfolio Review (CPR)).
- (3) The Army Requirements Oversight Council (AROC) reviewing the ICD must be a decision-making forum authorized to scope the AoA and isolate concepts for refinement.
- (4) The AROC Memorandum (AROCM) must codify the decisions to constrain the AoA's scope.
- (5) The G-3 Capabilities Integration (CI) staff (now organized under G-8 FDS (Force Development – Studies, Analysis, and Technology Division) and referred to in this document as G-3 CI, Department of the Army, Military Operations (DAMO)-CI, or CI) continues to negotiate early with Office of the Secretary of Defense (OSD) Cost Assessment and Program Evaluation (CAPE) to ensure scope of AoA is workable.
- (6) AoA guidance should clearly identify decisions being supported and reflect AROC issues.
- (7) Jump-start AoAs by establishing a predictable resourcing strategy and AoA forecast to preclude cold start of M&S, data, and scenarios.
- (8) Continue central coordination of AoAs that are planned and in progress.
- (9) Codify decisions (AROC and Study Advisory Group (SAG)) to minimize mission creep.
- (10) Ensure appropriate SAG Chair and Membership.
- (11) Conduct parallel reviews in TRADOC, Headquarters, Department of the Army (HQDA), and OSD CAPE.

THE PROJECT EFFORT was conducted by Ms. Renee G. Carlucci, Center for Army Analysis, Resource Analysis Division.

COMMENTS AND QUESTIONS may be sent to the Director, Center for Army Analysis, ATTN: CSCA-RA, 6001 Goethals Road, Suite 102, Fort Belvoir, VA 22060-5230.

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1 INTRODUCTION

1.1 Analysis of Alternatives Process Review

In late March of 2016, the Army G-8 asked the Center for Army Analysis (CAA) to lead an effort to help the Army figure out how to shorten the Analysis of Alternatives (AoA) timeline. For those not familiar with what an AoA is, an AoA is an analytical comparison of the operational effectiveness, cost, and risks of proposed materiel solutions to gaps in operational capability. An AoA documents the rationale for identifying and recommending a preferred solution or solutions to the identified shortfall. Those familiar with AoAs in the Army might ask, “Why was CAA asked to do this study? They have nothing to do with AoAs.” Exactly. Since CAA is not involved at all in the AoA process, the CAA study leads could examine the AoA process activities with fresh eyes and be an independent arbiter for change recommendations.

The upfront sections in this report cover the background and purpose of AoAs, what they typically include, and how the Office of Cost Assessment and Program Evaluation (CAPE) determines “sufficiency” of the AoA as the gate for milestone (MS) approval. AoAs are required by statute for Acquisition Category I (ACAT I) programs. There are also a good number of documents required by statute or regulation at each MS.

A 2013 CAPE study examining 47 AoAs from 2008 to 2013 from all Services showed that AoA durations ranged from 3 months to 3 years with an average of 1.5 years, with the cost ranging from \$1.3M to \$15M each and an average of \$5M. We don’t have the Army figures yet, but a 2014 Air Force study found that “AoAs cost approximately one half of one tenth of one percent of total program costs (e.g., ~\$110M in AoA support impacted ~\$350B in decision-making).” The average AoA duration for the last 10 Army AoAs was ~13 months, with another 2 to 4 months for staffing and “sufficiency” determination depending on whether the program had Army or Office of the Secretary of Defense (OSD) oversight.

This process review found that no Army AoA has ever held up a Defense Acquisition Board (DAB) schedule. AoA performers have told us that they can always do an AoA quicker, but that those shortcuts can lead to a system that is unattainable or unaffordable. Based on all that was learned in the course of this study, the challenges and recommendations can be bundled in about five areas in three major categories.

1.2 AoA Process Improvement (PI) Study Advisory Group Membership

- Army G-3, Capabilities Integration (CI)
- Army G-8, Force Development (FD)
- Army G-8, Program Assessment & Evaluation (PAE) (FD, PAE, CAA)
- Army G-8, Center for Army Analysis (CAA)
- Assistant Secretary of the Army (Acquisition, Logistics and Technology) ASA(ALT)
- The Office of Cost Assessment and Program Evaluation (CAPE)
- TRADOC Analysis Center (TRAC)
- Army Materiel Systems Analysis Activity (AMSAA)
- Army Research Laboratory's (ARL) Survivability/Lethality Analysis Directorate (SLAD) ARL/SLAD
- The Deputy Assistant Secretary of the Army for Cost and Economics (DASA-CE)
- Army Capabilities Integration Center (ARCIC)
- Army Test and Evaluation Command (ATEC)
- Army Evaluation Center (AEC)

Figure 1. AoA PI Study Advisory Group Membership.

For this study, we engaged the community involved in the AoA process from all perspectives, including OSD CAPE. We examined the guiding documents, the numerous previous AoA reviews, collected case study information, and conducted interviews.

Figure 1 above shows the major organizations that were involved in the study.

1.3 Background

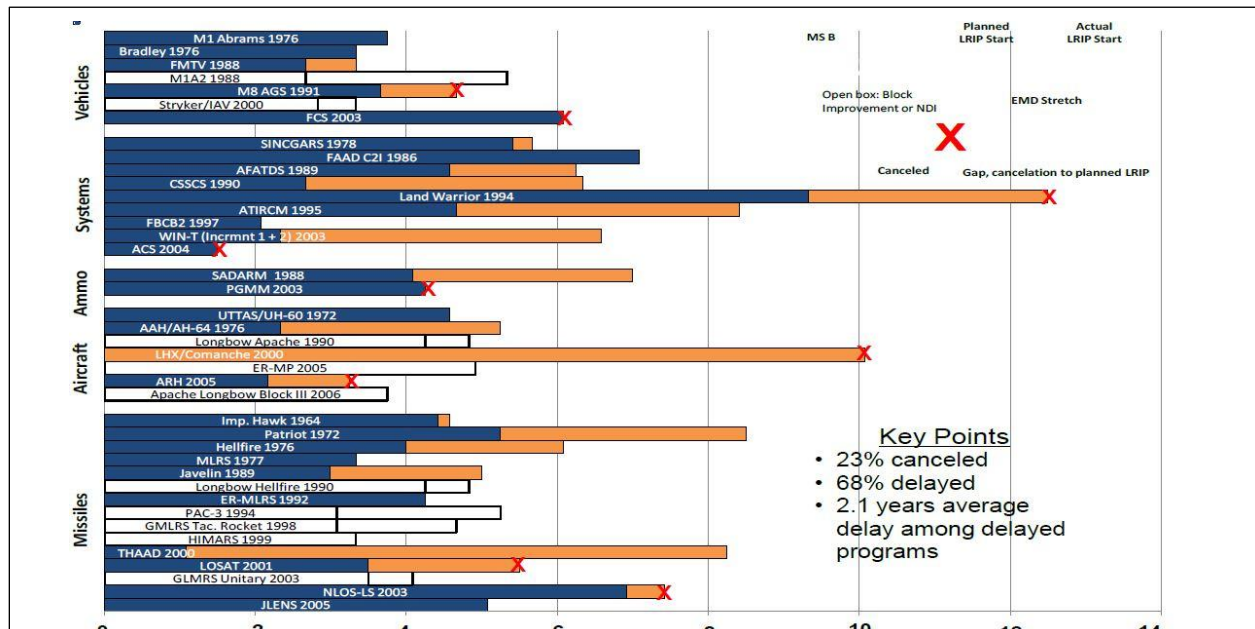


Figure 2. Army Programs (2010 Army Acquisition Review).

The Army has had a poor acquisition track record with too many cancellations, schedule slippages, cost over-runs, and failures to deliver timely solutions to the warfighters' requirements. This has led to numerous acquisition reviews, National Defense Authorization Act (NDAA)-directed acquisition reform, Congressional scrutiny, and calls from Army senior leaders for greater control. Figure 2 above captured in the "Army Strong: Equipped, Trained and Ready", Final Report of the 2010 Army Acquisition Review (otherwise known as the Decker/Wagner Report) highlights the high percentage of Army program cancellation and delays. The root causes for troubled and terminated programs usually stem from the developmental planning period from before Materiel Development Decision (MDD) to MS A and MS B.

In accordance with DoD 5000.02 (January 7, 2015) and the Weapon Systems Acquisition Reform Act (WSARA) of 2009: AoAs are a statutory requirement for Major Defense Acquisition Programs (MDAPs), Major Automated Information Systems (MAIS) programs, and all Automated Information Systems (AIS) programs at Milestone A. Updates are required through Milestone C (or Milestone B if there is no Milestone C) for MAIS programs, and all AIS programs.

AoAs consider a broad set of solutions, key trades among cost, schedule, performance, affordability analysis, risk analysis, and planning for risk mitigation.

The AoA will focus on identification and analysis of the proposed alternatives; measures of effectiveness; key trades between cost and capability; total life-cycle cost, including sustainment; schedule; concepts of operations; and overall risk. The AoA will inform and be informed by affordability analysis, cost analysis, sustainment considerations, early systems engineering analyses, threat projections, and market research.

There are two purposes for an AoA: 1) to provide information on the cost-effectiveness of alternatives considered with regard to mitigating identified capability gaps and 2) to inform development of requirements documents (primarily the Capability Development Document (CDD)).

The primary purpose of an AoA is to enable the Milestone Decision Authority (MDA) to make an informed acquisition decision; this is normally the Army Acquisition Executive (AAE) or the Defense Acquisition Executive (DAE). In this role, the AoA is a decision support analysis evaluating technologies or systems to provide information on the cost-effectiveness of the options or alternatives considered with regard to mitigating identified capability gaps.

The second purpose of the AoA is to inform development of requirements documents (primarily the CDD). In this role, the AoA tests the veracity of draft requirements and identifies the system/technology attributes of importance and the recommended values of those attributes to effectively mitigate the identified capability gaps.

1.4 Problem, Purpose, and Objectives

- Problem Statement
 - The Army requires AoAs and supporting analyses that satisfy decision-makers' critical information requirements that are delivered in a timely manner.
- Purpose
 - Develop an approach to focus AoA activities to most efficiently and effectively deliver results that meet decision-maker needs.
- Objectives
 - Lay out all the analysis-related AoA process activities (including pre- and post-AoA activities).
 - Identify issues in the current AoA process.
 - Identify potential solutions to issues, as well as the organizations with the authority to enact the solutions.
 - Lay out the various decision makers who use AoAs and supporting analyses, their needs, and the potential consequence of meeting or failing to meet their needs.

Figure 3. Problem, Purpose, and Objectives.

Some Army senior leaders have complained that AoAs take too long and cost too much. Lt.Gen. John M. Murray, Deputy Chief of Staff, G-8, requested that CAA take on this effort to help the Army figure out how to shorten the AoA timeline. The problem statement was later refined to the one shown in Figure 3 above.

Merely shortening the timeline of the AoA is not sufficient. Many of the AoA performers agreed that they could always take less time to complete an AoA. However, that would often result in shortcuts being taken that can affect the results of the AoA. CAPE leaders interviewed reported that when they don't get a good rigorous AoA, the performers often end up having to redo it. They also reported that AoAs are often started with insufficient work on the requirements and that this is a problem they are seeing from all the Services. Shortcuts taken in the AoA or

insufficient work done in the requirements process has often lead to a system that is unattainable or unaffordable.

So the question asked became, “How can the Army improve its process for conducting AoAs to ensure that DoD has appropriately-scoped, sufficient, and timely analysis to inform requirements development and acquisition decisions for the highest priority Army systems, while maximizing efficiency of scarce analytic resources?” We also learned that there are now many stakeholders and AoA customers that actively use the analysis (e.g., Acquisition Executives, Joint Requirements Oversight Council (JROC), Planning, Programming, Budgeting, and Execution (PPBE) process, and Congress). All of these are or have decision makers that use AoAs and can significantly affect a program.

1.5 Scope/Methodology

- Week 1 - 25 March to 1 April 2016
 - Identification of Study Advisory Group (SAG) Participants/ Division of Labor
 - Case Study Identification
 - CAA reviews Decker-Wagner recommendations
 - Confirm SAG Battle Rhythm
 - Weekly VTCs, Telecoms, Virtual
 - Identify alternate DTGs
 - Plan Interviews
- Weeks 2 & 3 – 4 to 15 April 2016
 - Conduct Case Study Analysis
 - Continue Literature Review
 - Conduct Planned Interviews
 - Map Process Activities
 - Conduct SAG Findings Review to Establish Consensus
- Week 4 – 18 to 22 April 2016
 - Draft & Staff Briefing of Results
 - Draft Report

Figure 4. Scope/Methodology.

Given the short duration of the study, just 30 days, the study team chose to utilize a Study Advisory Group (SAG) composed of all the pertinent stakeholders. This report encompasses information provided by members across the SAG. Our methodology, shown in Figure 4 above, was fairly simple. We utilized the advice of the SAG to identify a good mix of AoA case studies (encompassing all ACAT levels and those considered good examples and those that encompassed challenges), reviewed guiding literature and previous AoA reviews, conducted interviews with stakeholders, and mapped the process activities and durations.

We tasked the SAG members with providing the information required on case studies and process activities with timelines and conducted weekly SAGs to review ongoing findings and establish consensus. The SAG members included AoA performers (U.S. Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC), Army Materiel Systems Analysis Activity (AMSAA), Army Capabilities Integration Center (ARCIC), Army Research

Laboratory's Survivability/Lethality Analysis Directorate (ARL/SLAD)), the Deputy Secretary of the Army for Cost and Economics (DASA-CE), OSD CAPE, Assistant Secretary of the Army (Acquisition, Logistics and Technology) ASA(ALT), G-3 Capabilities Integration (CI), and G-8.

The SAG agreed that the study should address AoA prioritization and scope. Whoever sets the priorities must coordinate with G-3, G-8, and ASA(ALT). Whoever governs the scope of the AoA should be able to coordinate with CAPE, G-8, G-3, ARCIC, TRAC, and AMSAA.

The study team should examine the "As Is" process mapping. What are the inputs, outputs, timelines, and responsibilities for each step of the process? What constraints are there to the "As Is" process? In order to determine the "To Be" process improvement and layout: What changes are needed? Who can affect the changes? What are the expected time saves/cost/risk of any changes? Regarding utilization of case studies for both "good" and "challenged" AoAs, What does "right" look like? What problems lead to a "challenged" AoA? How do we eliminate, mitigate, or solve these? The study team should utilize TRAC's AoA Primer and previous acquisition reviews (Decker-Wagner, etc.).

The study team should also examine development of the AoA Study Directive and Guidance. What needs to be included? How should it be developed? It should cover inclusion of statutory/regulatory requirements and elicited decision maker analytic needs.

Regarding the technical review of a given AoA including the AoA's SAG: What should the reviews be geared to accomplish? Are the requirements and gaps defined and scoped sufficiently prior to the start of the AoA process? Is the AoA covering the right alternatives, requirements, mission profiles, and scenarios?

The study must look at improving the SAG process with the first SAG used to narrow down the requirements. There is a need for up-front mission analysis and up-front Senior Leader guidance from both Army leadership as well as OSD leadership - before proceeding on the AoA. The number of alternatives and additional tasks added throughout AoA process drive the scope and timeline. Does the AoA sufficiently address the research questions to inform the next acquisition decision? Who should participate? When should reviews be conducted (iterative)? What should be the relationship between the Army Requirements Oversight Council (AROC) and the SAG?

Funding for AoAs and pre-MDD analytical activities has long been a problem. This study should identify measures to improve the funding process. What are the options for whom/what office should synchronize AoAs for the Army? Should we have a single office responsible for the prioritization, scope/measurement space, and study directive/guidance for AoA activities? Finally, this effort needs to consider pre/supporting AoA activities, i.e., analytic efforts to develop the Initial Capabilities Documents (ICD), CDD, and Capability Production Document (CPD).

2 AoA PRIMER

2.1 The Capabilities-Based Assessment to AoA Linkage

The Joint Capabilities Integration and Development System (JCIDS) Manual describes the Capabilities-Based Assessment (CBA) as the analytic basis to identify capability requirements and associated capability gaps prior to development and submission of capability requirement documents for review and validation. The CBA is the start point for the deliberate requirements process and leads to the development of the ICD. This analysis is meant to define the mission, identify capabilities required, determine the attributes/standards of the capabilities, identify gaps, assess operational risk associated with the gaps, prioritize the gaps, identify and assess potential non-materiel solutions, and provide recommendations for addressing the gaps. The intent of a CBA may also be satisfied through one or more other studies or analyses, as long as the analytical rigor and breadth of analysis is covered by the collective analytical efforts.

The CBA does not provide specific recommendations as to a particular materiel solution, but rather provides a more general recommendation as to the type of materiel solution (whether it is an incremental improvement to an existing capability, or an entirely new capability). In this way, the ICD is used to establish boundary conditions for the scope of alternatives to be considered in the subsequent AoA.

TRADOC, with many stakeholders, conducts a centralized Capabilities Needs Analysis (CNA), which assesses the needs of the whole Army, not specific systems. They don't have the resources to do systems-level requirements analysis for all systems. However, the TRADOC Centers of Excellence (CoEs) conduct some special CBAs via functional analyses to prioritize gaps and solutions. These are narrower in scope and for specific gaps. These are integrated with the overarching CNA. Other analyses and activities, such as the Campaign of Learning (CoL) and the Army Warfighting Assessment (AWA) are also inputs to the CNA. The CNA is TRADOC's primary future force prioritization tool and serves as TRADOC's position in informing the Program Objective Memorandum (POM) (primarily the Equipping (EE), Sustaining (SS) and Training (TT) Program Evaluation Groups (PEGs) and Long-range Investment Requirements Analysis (LIRA). It serves as the Army's integrated CBA.

AoAs require a great deal of information on the proposed alternatives such as organizational and operational concepts, employment tactics, techniques, and procedures (TTP), market research on technologies, and analytic tool development (to represent the new concepts and TTP). This is all work that, if not done in the proponents CBA or the Program Executive Office (PEO) or Program Manager (PM) market research for technology solutions, will add a significant amount of time on the front end of any AoA.

2.2 Typical AoA

- [cost effectiveness of the technologies](#) or systems under consideration.
- [cost-schedule-performance trades](#) analysis (introduced by WSARA 2009).
- [performance level analysis](#) (specific to the technologies under consideration).
- [operational benefit analysis](#) to determine to what extent the technology/system mitigates the capability gap(s) identified in the ICD.
- [lifecycle cost analysis](#) for the expected life of the technology/system (using the cost analysis rules from OSD Cost Analysis and Program Evaluation (DCAPE)).
- [risk assessments](#) on the technologies/systems in the areas of cost, performance, schedule, and operational benefit/effectiveness.
- analysis of [technology readiness](#).
- [reliability and sustainment](#) analysis.
- [Assess Fully burdened cost of fuel](#) and [Operational Energy analysis](#) (if applicable).
- [Affordability Analysis](#), in the Army this is conducted in the Army G-8.

Where relevant, OSD CAPE requires analysis be:

- **Scenario-based, preferably in a region of key interest.**
- **Utilize quantitative analysis over qualitative analysis.**

Figure 5. Typical AoA.

A typical AoA includes the elements shown in Figure 5 above. As discussed above, without the knowledge necessary to conduct analysis on the proposed alternatives, these study components will be difficult or impossible to develop. There are no rules specifying when to update an AoA. It has become standard OSD CAPE practice to develop AoA guidance for the initial MS A AoA that is very broad and covers the life of the acquisition process. The intent is that only one AoA is needed, however this has led to problems by significantly increasing the scope of the analysis beyond what is needed for the milestone decision and beyond the level of knowledge developed and available at the time. As a result, AoA updates are very commonplace. Some reasons for updates are: (1) Knowledge is now developed and available to address decision maker questions that could not be addressed in an earlier AoA. (2) Threat projections have changed significantly since the last AoA. (3) United States (U.S.) force concepts and operations have changed significantly since the last AoA. (4) Technology (threat or U.S.) has significantly changed since the last AoA.

2.3 How an AoA is deemed “sufficient”

In accordance with the DoDI 5000.02 (page 126, Enclosure 9), DCAPE provides a memorandum to the MDA assessing*:

1. The extent to which the AoA:
 - a) Examines sufficient feasible alternatives.
 - b) Considers tradeoffs among cost, schedule, sustainment, and required capabilities for each alternative considered.
 - c) Achieves the affordability goals established at the MDD and with what risks.
 - d) Uses sound methodology.
 - e) Discusses key assumptions and variables and sensitivity to changes in these.
 - f) Bases conclusions or recommendations, if any, on the results of the analysis.
 - g) Considers the fully burdened cost of energy (FBCE), where FBCE is a discriminator among alternatives.
2. Whether additional analysis is required.
3. How the AoA results will be used to influence the direction of the program.

*from DoDI 5000.02, Enclosure 9, page 126.

Figure 6. How an AoA is deemed “sufficient”.

From some of the guiding literature, Department of Defense Instruction (DoDI) 5000.02, the AoA assesses potential materiel solutions that could satisfy validated capability requirement(s) documented in the Initial Capabilities Document, and supports a decision on the most cost effective solution to meeting the validated capability requirement(s). In developing feasible alternatives, the AoA will identify a wide range of solutions that have a reasonable likelihood of providing the needed capability. Figure 6 above describes the criteria for CAPE to assess “sufficiency” of an AoA.

While Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01I is silent on the purpose of the AoA, the below passage gives an idea of the AoA purpose: "The validated ICD is a critical entry criterion for the MDD, and guides the Sponsor [Materiel Solution Analysis (MSA)] phase activities and assessment of potential materiel solutions through an AoA or other studies.... (b) Post-AoA Review. Following Sponsor completion of the AoA, the post-AoA review provides the validation authority and other stakeholders the opportunity to assess how the different alternatives address the validated capability requirements and associated capability gaps, and at what life cycle costs. The post-AoA review shall be completed in sufficient time to permit Sponsor preparation of a draft CDD or similar documentation prior to MS A... The post-AoA review is not a validation of the AoA results, but rather informs the validation authority's advice to the [MDA] on the AoA results, recommended alternative(s), and proposed [Key Performance Parameters (KPPs)], Key System Attributes (KSAs), and Additional Performance Attributes (APAs)."

In short the CAPE assessment evaluates if the study team did what was specified in the guidance; how well the work was done; and if the work provides relevant, credible analysis to support the milestone decision.

One important note is that the AoA does not make the acquisition decision but rather provides information on the cost-effectiveness of the alternatives for the decision makers to combine with other relevant information to make an informed acquisition decision.

2.4 Milestone A Documents Required

Example from existing program									
Document	Status (Color Code)	Owner	Current Location	Final Approval Authority	If appl, PEO Approved? (Yes/No/N/A)	If No, Expected Date PEO Approval	Expected Date, Approval Authority	Required Date, Approval Authority	Comments and Mitigation
2366 Certification Memorandum (S)		PM/USD ATL	PM	MDA	N/A	N/A	15 Apr 16	30 Jun 16	Draft due prior to OIPT
--BCA		PM/USD ATL	PM	MDA	N/A	N/A	10 Apr 16	15 Apr 16	Draft due prior to OIPT
Acquisition Decision Memorandum (R)		PM/USD ATL	PM	MDA	No	22 April	30 May 16	30 May 16	Draft due prior to OIPT, DRM will provide formal input 16 Jun 16
Acquisition Strategy (S)		PM	PM	MDA	No	18 Mar 16	15 May 16	1 Jun 16	In formal staffing as of 15 Mar 16
Affordability Analysis (R)		G8 P&E	G8 P&E	MDA	N/A	N/A	19 May 16	19 May 16	Goal established at MDD; validated during CRB process
Analysis of Alternatives (S)		TRADOC	DCAPE	DCAPE	N/A	N/A	31 Mar 16	31 Mar 16	Signed by TRADOC on 17 Feb 16; pending Sufficiency Memo
Capability Development Document (R)		DA G3/5/7							JROC Approved PAC-3 CDD (15 Aug 13), Need user input
Clinger-Cohen Act Compliance (S)		PM	PM	CIO	No	12 Apr 16	1 Jun 16	15 Jun 16	Finalized after Cyber Security Strategy approval
Concept of Operations/Operational Mode Summary/ Mission Profile (CONOPS/OMS/MP) (Update) (R)		TCM	TCM	DA G3/5/7	N/A	N/A	18 Mar 16	15 Jun 16	Pending TCM updates
Contractor Cost and Software Data Reporting		PM	PM	DCARC					Not required for TMRR.
Core Logistics Determination/Core Logistics & Sustaining Workloads Estimate (S)		PM	APEO LOG	MDA	No	18 Mar	1 Jun 16	15 Jun 16	Pending AMCOM brief 25 April 16, prior to signature. Only CLD required for MS A; in the LCSP
Cost Analysis Requirements Description (CARD) (R)		PM	ASA(ALT)	ASA(ALT)	Yes	26 Feb 16	18 May 16	1 Jun 16	In formal staffing, Addendum due 24 Mar 16 to PEO
Cybersecurity Strategy (S)		PM	APEO- OPNS	CIO	No	2 Apr 16	1 May 16	27 May 16	Appendix to the PPP
DoD Component Cost Estimate (Project Office Estimate) (R)		PM	PM	ASA(FMC)	N/A	N/A	5 Apr 16	18 Apr 16	<div>Complete</div> <div>On Schedule</div> <div>Resolvable Schedule Issues</div> <div>Cannot Meet Schedule</div>
DoD Component Cost Position (Army Cost Position) (R)		DASA-CE	DASA-CE	DASA-CE	N/A	N/A	18 May 16	25 May 16	

Figure 7. Milestone A Documents Required (1 of 2).

Document	Status (Color Code)	Owner	Current Location	Final Approval Authority	If appl, PEO Approved? (Yes/No/N/A)	If No, Expected Date PEO Approval	Expected Date, Approval Authority	Required Date, Approval Authority	Comments and Mitigation
Frequency Allocation Submission (DD Form 1494) (S)		PM							Stage 1 submitted 12 March 2015 to ASMO
Full Funding Certification Memorandum (R)		G8 P&E	PM	AAE/ASA(FMC)	No	18 May	23 May 16	31 May 16	Must be signed by AAE and ASA(FMC); follow cost position approval
Independent Cost Estimate (S)		CAPE					28 Jun 16	30 Jun 16	Prepared by DCAPE CAIG
Item Unique Identification (R)		PM							Part of SEP and Annex to LCSP. Per APEO LOG not required for MS A
Life-Cycle Mission Data Plan (R)		PM	DIA	DIA	N/A	N/A	15 Apr 16	15 Apr 16	DIA IMDC stated they will not hinder MS decision; will provide conditional acceptance if required
Life-Cycle Sustainment Plan (R)		PM	PEO DASM	MDA	No	23 Mar 16	1 Jun16	15 Jun 16	Pending AMCOM brief 25 April 16, prior to signature.
Program Protection Plan (R)		PM	PM	MDA	No	31 Mar 16	1 June	15 Jun 16	Pending final correction from Jerry Mangino
Replaced System Sustainment Plan (S)		PM							Not required per APEO LOG
DRAFT-Request for Proposal (R)		PM/ ACC-NJ	PM	MDA	No	9 May 16	30 Jun 16	30 Jun 16	Pending AS approval; draft will be released ~May; RFP after DAB
Should Cost Target (R)		PM	PM	MDA	No	29 Apr 16	2 May 16	16 May 16	Predecessor: CARD, POE, CCE, ICE, ACP
Spectrum Supportability Risk Assessment (R)		PM	PM	CIO/G-6	Yes	7 Jan 16	1 Apr 16	15 Apr 16	ASMO/CIO G-6 will provide a positive spectrum supportability assessment.
System Threat Assessment Report (STAR) (R)		PM							Using AAMD STAR validated by DIA 11 March 2015
System Engineering Plan (SEP) (R)		PM	PEO CE	DASD(SE)	No	23 Mar	15 May 16	31 May 16	Document was submitted to DASM
Technology Targeting Risk Assessment (TTRA) (R)									Complete
Test and Evaluation Master Plan (TEMP) (R)		PM	PM	DDTE/DOTE	No	2 May	1 Jun 15	15 Jun 15	On Schedule
									Resolvable Schedule Issues
									Cannot Meet Schedule

Figure 8. Milestone A Documents Required (2 of 2).

Figure 7 and Figure 8 above show all the documents required for a recent program at Milestone A. As one can see, there are many products required prior to Milestone A, not just the AoA. From our interviews and case study analysis, we could find no example of an AoA delaying a DAB.

2.5 Current AoA Landscape

- Ongoing AoAs
 - Army-led:
 - 1. Lower Tier and Missile Defense Capability (LTAMDC) (ACAT 1, CAPE oversight) [Final Report complete; the Army considers the AoA complete once CAPE assesses analytic sufficiency]
 - 2. EAB M113 Family of Vehicle Replacement (Congressionally-directed, no MDD - projected ACAT 1, HQDA oversight)
 - 3. Dominating Terrain through Terrain Shaping and Engagement (DMTTS&E), Inc 1 (GATOR replacement) (ACAT 1D, CAPE oversight)
 - 4. Ground Mobility Vehicle (GMV) (ACAT III, TRADOC Oversight)
 - Joint (Army-supporting): 5. Cyber UNIFIED PLATFORM (ACAT I, CAPE oversight, USAF-led)
- Pre-MDD work for AoAs not yet started:
 - 1. Next Generation Biometric Collection Capability (NXGBCC) (ACAT 1C, HQDA oversight) [AoA Study Guidance staffing complete - signature imminent]
 - 2. Future of Vertical Lift, Medium (ACAT 1D, CAPE oversight) [AoA Study Guidance in Development]
 - 3. Automated Convoy Operations (ACAT 1D, CAPE oversight)
 - 4. Electronic Warfare - Defensive Electronic Attack (EW-DEA) (ACAT 1, CAPE oversight)
 - 5. Common Remotely Operated Weapon Station (CROWS) Inc 2 (ACAT 1, CAPE oversight)
 - 6. Global Force Information Management (GFIM) (ACAT III, HQDA Oversight)
 - 7. Mobile Protected Firepower (MPF)

Figure 9. Current AoA Landscape.

At the time of our AoA Process Improvement study, G-3 CI advised us that the current AoA landscape consisted of the ongoing AoAs listed in Figure 9 above as well as Pre-MDD work for future AoAs also listed above. There is also a much longer list maintained of potential AoAs for Fiscal Year (FY) 2018 and FY 2019 (not shown).

3 INTERVIEWS

3.1 Overview

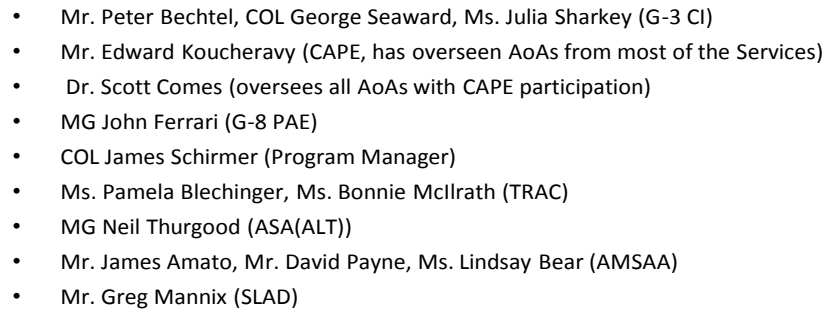
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- Mr. Peter Bechtel, COL George Seaward, Ms. Julia Sharkey (G-3 CI)
 - Mr. Edward Koucheravy (CAPE, has overseen AoAs from most of the Services)
 - Dr. Scott Comes (oversees all AoAs with CAPE participation)
 - MG John Ferrari (G-8 PAE)
 - COL James Schirmer (Program Manager)
 - Ms. Pamela Blechinger, Ms. Bonnie McIlrath (TRAC)
 - MG Neil Thurgood (ASA(ALT))
 - Mr. James Amato, Mr. David Payne, Ms. Lindsay Bear (AMSAA)
 - Mr. Greg Mannix (SLAD)

Figure 10. Interviews.

Due to the short timelines of the study, we were not able to interview all of the desired stakeholders. Figure 10 above shows the list of individuals that we formally interviewed. Obviously, all participants in our SAG were able to provide regular feedback and comments through the course of all our SAG discussions as well. Many of the comments received during the interviews echo those things highlighted in the lessons learned and other AoA reviews we examined. We highlight the following points or recommendations heard during the interviews aggregated based on their nature and generally not attributed.

3.2 Pre-AoA Activities

Several interviewees, citing specific examples, stressed the need for the Army to do more analysis during the requirements process. Typically, the AoA takes the requirements as semi-gospel and determines the best way to meet them. The Army needs to do a better job of cost-informed trades before it launches a program. There was a recommendation for a single PM-like organization with engineers, science and technology expertise, and cost analysts to oversee work done before a program is launched. CAPE has formulated a series of recommendations to improve the requirements process in all the Services and using a CBA with increased analytical rigor, considering how affordability affects trade space, and prioritizing capability gaps based on mission consequences to help determine material solution trade space. They also recommend standing up a Service-led SAG with external stakeholders for each CBA, similar to what is done for the AoA (see section E-8).

Another concern highlighted is the lack of a senior analyst for the Army to assist with the oversight and prioritization of pre-AoA analytical activities. At one time the Army had a Deputy Under Secretary for Operations Research (DUSA-OR), Mr. Walt Hollis, to fulfill this role. He worked to improve the relationship between the testers, the acquisition community, and the analysts as well. Ms. Blechinger is currently the lead analyst for TRADOC, but doesn't have any oversight role in ARCIC. ARCIC's last senior executive analyst billet held by Mr. Al Resnick, was abolished after his retirement. Consequently, the most senior analyst in ARCIC is at the Colonel or General Schedule (GS)-15 level. A recommendation of the Decker-Wagner Study was to restore the DUSA-OR function.

3.3 AoA Prioritization and Funding

One of the benefits of the Capability Portfolio Review (CPR) process, over and above the AROC, was the prioritization of gaps. The CNAs are getting better and including gaps from Combatant Command Integrated Priority Lists (IPLs) and from Army Commands (ACOMs). The portfolio aspect of the CPRs allowed senior leaders the ability to emphasize gaps. That, along with a requirements to resources process, allows backwards planning and programming to resource forthcoming AoAs. Unfortunately, the funding plan has not always been in line with senior leader guidance.

When ARCIC was created, resources were pulled out of TRADOC. The question has been how much workload can they push to MDD analysis? A better assessment of their capability is needed. The acquisition lane has a role in this as well. What can they do to help? There is a relationship of Science and Technology (S&T) guidance to pre-MDD analysis and then to the AoAs. How can we connect all of the various activities (e.g., work in the areas of counter-Unmanned Aerial Surveillance (UAS), directed energy, lasers, precision fires, known threat vectors, and technology demonstration activities) to a discrete capability that a future PM will use? Forward-looking guidance needs to be given for all of these activities and the activities need to be federated to support requirements. While G-3/5/7 currently lays out a prioritization for AoAs, these are not always in line with senior leader priorities. The pre-AoA work being done may also not align with these priorities. Finally, DoD priority targets are not necessarily in line with Army priority targets. Many of the interviewees cited the need to get senior leader priorities and questions early on.

The Army assumption is the need for approximately \$10M in funding per year for AoAs. (TRAC pointed out that some years that can be as high as \$20M, which they have accomplished using mission funding.) Delays in distributing AoA funding has not only led to delays in accomplishing AoAs, but has resulted in under-execution and marks taken. Several interviewees cited the need for dedicated funding for AoAs, utilizing a 1- or 2-star forum for periodic reviews of the spending plan in order to shift funding as needed between AoA performers. Both TRAC and AMSAA have executed their ever-increasing AoA mission with a combination of mission and reimbursable funds. Providing the executing agencies with funds at the beginning of the FY and allowing flexibility between AoAs, depending on prioritization, is critical. Ensuring that procedures are in place to properly allocate funds to the agencies making up the team is also critical. Recommend TRAC and AMSAA work the latter.

3.4 AoA Purpose

The AoA is more than just the acquisition choice of A, B, or C. It informs understanding of concept of operations (CONOPS) as well as how a product will be developed. Here the choices and data analysis can inform the trade space. Are we trying to prove an already demonstrated technology or trying to understand what would be best? For example, some in OSD want a real long-range weapon – but it probably won't have a big warhead. The AoA really informed that debate. The second purpose of the AoA is to build consensus within the Army and outside parties.

3.5 AoA Quality, Impact, Speed/Duration

CAPE finds the quality of Army AoAs to be very good. While more concerned about the quality, they are also more than happy with the speed of Army AoAs. Several interviewees made the point that if the AoA isn't sufficiently rigorous, then it ends up being re-done, taking even more time.

CAPE highlighted that the language in the AoA guidance regarding cost analysis is boilerplate: "rigorous but not budget quality". This may be an area for time saving. There is a need to distinguish between alternatives and provide information on cost drivers, but may not need all the costing work done up front. An AoA isn't about quantity, but life-cycle costs need an estimate of how many you might have. Lifetime of missile, for an example, can be a huge factor; G-8 does a pretty good job of the affordability layer on top of the AoA. How many to buy, the cost to service an upgrade, lifetime to service: these support a budgeting decision. Just a rough order of magnitude is needed for affordability. Experience has been that cost of a missile is very well done by TRAC-White Sands Missile Range (WSMR), but life-cycle costs are often done outside of an AoA. CAPE frequently finds that life-cycle costs can be more important than the individual cost of the missile. The driving assumptions, driven by the PM (typically not analytically derived), will drive the total cost of the program.

CAPE's goal for AoA duration is 9 months or less from the first SAG to Final Brief (not report). Typically, CAPE oversees one to two Army ACAT I programs, but sometimes three to four. When there is good communication across the team, AoAs tend to be well defined, with a clear set of alternatives and well-scoped and defined scenarios. When there is less robust communication, the scope changes, alternatives change, and timelines get extended. Typically, alternatives will drop during the course of the study. If the work is done right, people can have different opinions about the trade space.

One concern highlighted was the lack of appreciation by senior leaders of what it takes to get item-level performance data characteristics. Conducting the research and development for new items is time intensive. Getting physical properties from Research and Development Centers (RDECs) and the S&T community for these things and putting them into the simulations takes a lot of time. More advanced notice is needed in order to get the information required and the developmental test data released.

3.6 Study Advisory Group (SAG)

For OSD-led SAGs, pre-SAG coordination with OSD CAPE and Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD(AT&L)) helps alleviate any issues or surprises before the SAG. The SAG membership will typically include the Joint Staff, AT&L, other Services (if they have an interest), Army stakeholders, and sometimes combatant commands.

At the time of the interviews, Mr. Pete Bechtel chaired the Army-led SAG. However, several interviewees cited that 50 percent of the time, Mr. Mike Moore, a GS-15, would actually chair the SAG. When the Army had a DUSA-OR, Mr. Walt Hollis, a senior executive, would chair the SAGs and ensure consistent membership and discipline in the process. His senior rank, analytical chops, and oversight of all analysis from cradle to grave of a program helped to ensure consistency in the process. Several interviewees cited the need for the Army SAG chair to have

enough seniority (civilian or military) to manage all the stakeholders and to be an analyst themselves so that they would understand the implications of any scope changes on the analysis.

3.7 Army Requirements Oversight Council /Senior Leader Involvement

Prior to this study, AROC staffing via paper was the process --which was not optimal for divining senior leader concerns, questions, or guidance. More recently, the “enhanced” AROC has senior leader involvement in ACAT I/MAIS programs. An AROC may not (can’t) be needed for every program, but more work needs to be done to find out what information both the Senior leaders and the AoA performers need to make their decisions or lay out their analyses. AoAs need to have regular checkpoints with decision-makers. The AROC can provide the performers with the Service-guidance that they need to proceed with the AoA. The AoA should be tailored to meet the needs of both DoD and the Service leaders. Currently, technical analysts write the AoA guidance. The AROC should approve the study guidance and questions. For a program with OSD oversight, some negotiation may be required in order to ensure that the AoA is tractable given the funding and timelines.

4 CASE STUDIES

4.1 Case Study Analysis

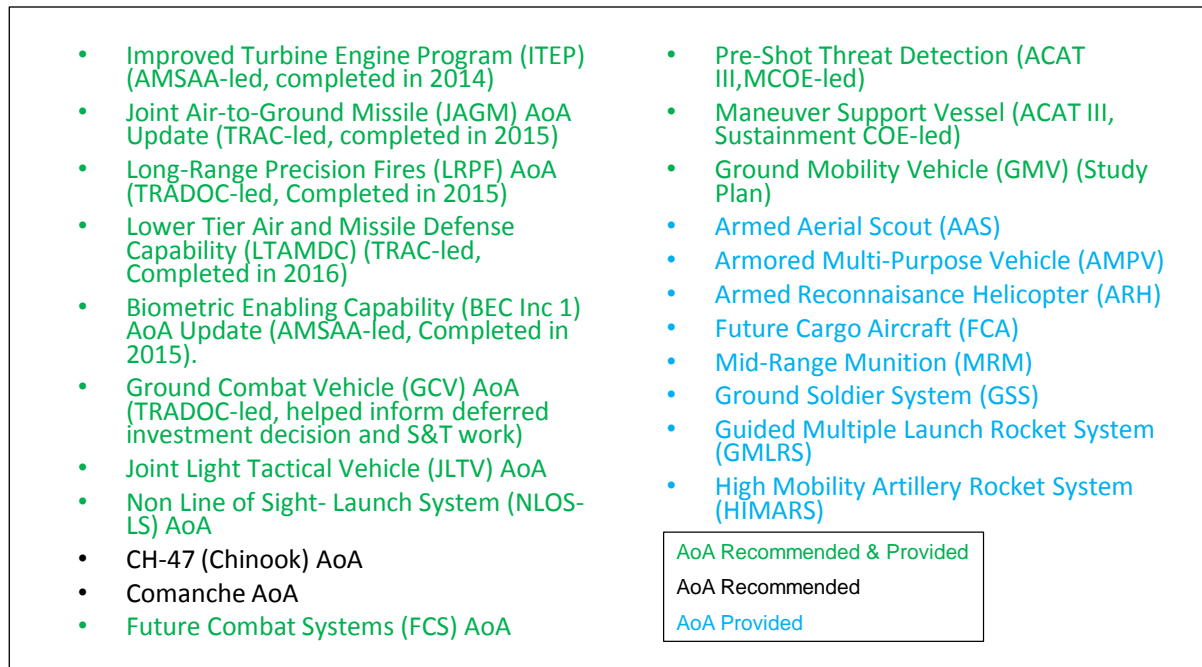


Figure 11. Case Studies.

The SAG developed a list of post –WSARA AoAs that would cover the gamut based on ACAT level and performer (see Figure 11). This list includes some great success stories as well as AoAs that were challenged in some way. The SAG members provided the AoAs, data items, and answers to a series of questions about the AoAs. We assembled these in a spreadsheet (See Figure 12 for a G-3 CI Chart). Regarding AoA practices, the Long-Range Precision Fires (LRPF) AoA contained almost every process element required in typical guidance (multiple alternatives, extensive trades analysis, operational effectiveness, performance analysis, cost and affordability analysis, risk analysis, multiple scenarios and models and simulations (M&S), etc.). It also took quite a bit of time to conduct because of this extensive scope. The ongoing Ground Mobility Vehicle (GMV) AoA is an example of an AoA that was specifically tailored to address only questions of concern to the decision-maker. Because of that, the AoA is greatly streamlined.

Between 1 July 2013 and 8 April 2016, TRADOC conducted exactly two ACAT III AoAs: Pre-Shot Threat Detection at Maneuver Center of Excellence (MCoE) (Benning), and Maneuver Support Vessel - Light at Sustainment CoE (Lee). They began another one because regulations required an AoA though ARCIC (and the MDA) did not believe it needed to be done (Light Engineer Utility Trailer). They consequently terminated this study immediately following the study plan approval briefing. ARCIC also has one ACAT I-like study that the MCoE is leading (Small Arms Ammunition Configuration) that is AoA-like in scope, rigor, and defensibility, but is *not* an AoA.

In part, ARCIC accomplished this low AoA rate using two different, but complementary methodologies. The first is that through 30 September 2015, ARCIC conducted an Analysis Assessment of Sufficiency for every ACAT III CDD, *and* every CPD, in order to determine if the existing body of knowledge is sufficient to meet the fundamental purpose of an AoA as described above. Of the ~45 Finding Memos issued through 30 September 2015, all but 2 found that the fundamental purpose of an AoA had been met, and so the Army 'avoided' conducting an AoA in more than ~95% of cases. [In the case of those two, both requirements had achieved AROC approval in 2009, and were components of an Engineering set (Concrete Saw, and Asphalt Patcher) that was assessed in concert with the MDA that there were no information needs that the AoA would provide. Consequently, the MDA completed some market research and fielded the capability.]

Beginning 1 October 2015, ARCIC implemented a new methodology co-developed with TRAC and DASA-CE to determine the appropriate level of comparative analysis for each specific requirement. The information paper found in section F-10 succinctly communicates the background, and shows the process flow. This methodology allows the use almost exclusively of a Cost Benefit Analysis for CPDs as the appropriate level of analysis. The reason for this is that the analysis required to support a CPD must address quantity, such as which units get the capability, in which quantities, and on what timeline. The Cost Benefit Analysis is ideally suited for CPD kind of analyses. With a CDD, it is not quite so simple, as the supporting analysis must address the preferred set of system attributes to support a decision of whether to pursue production and fielding, or not pursue. Therefore, those cases use the Analysis of Assessment of Sufficiency for CDDs. Given their past ~95% rate of meeting the AoA requirement with prior analytical work, ARCIC doesn't anticipate any increase in ACAT III AoAs in TRADOC.

Actually, there is a third ACAT III AoA in TRADOC, which TRAC is performing; the Ground Mobility Vehicle discussed above. This is the AoA TRAC wanted to use as a proof of principle to demonstrate how we might address the analytical need by only addressing the 'tipping points'.

4.2 Army AoA Case Study Analysis (Recent AoAs)

CAPE Oversight												
Program	ACAT	Date of MDD Request Memo	Key Pre-MDD Activities	Date of MDD ADM	Date of 1st SAG	Final Report Complete	AoA Length (months)	Final Report Submitted to Oversight Authority	AoA Staffing (months)	AoA Sufficiency	Analytic Sufficiency Determination (months)	Time 1st SAG to Sufficiency (months)
AMPV	1D	10/25/2011	See note	3/16/2012	4/3/2012	8/15/2012	4	8/17/2012	0	11/21/2012	3	8
LTAMDC	1D	5/29/2014		2/2/2015	1/21/2015	12/31/2015	11	4/19/2016	4	6/30/2016	2	17
LRPF	1D	2/28/2013		11/6/2013	12/4/2013	4/30/2015	17	7/17/2015	3	9/14/2015	2	21
ITEP	1D	4/30/2012		11/16/2012	12/13/2012	6/1/2014	18	7/10/2014	1	10/1/2014	3	22
JAGM Inc I Update	1C	None		11/17/2014	12/3/2014	6/22/2015	7	6/23/2015	0	7/20/2015	1	8
IFPC Inc 2	1C	11/5/2010		8/7/2011	11/16/2011	4/30/2013	17	6/12/2013	1	9/13/2013	3	22
GCV (MS A)	1D	11/3/2009		5/11/2010	12/15/2009	3/24/2011	15	3/30/2011	0	7/18/2011	4	19
Average							13		1		3	17
Army Oversight												
Program	ACAT	Date of MDD Request Memo	Key Pre-MDD Activities	Date of MDD ADM	Date of 1st SAG	Final Report Complete	AoA Length (months)	Final Report Submitted to Oversight Authority	AoA Staffing (months)	AoA Sufficiency	Analytic Sufficiency Determination (months)	Time 1st SAG to Sufficiency (months)
BORES	II	7/5/2012	See note	9/30/2013	12/18/2013	2/28/2015	14	4/30/2015	2	6/1/2015	1	17
H-47 Block II	1C	9/29/2014		2/20/2015	4/6/2015	12/1/2015	8	12/2/2015	0	1/13/2016	1	9
BEC AOA Update	1A	None		8/6/2014	8/8/2014	12/1/2015	16	12/1/2015	0	12/23/2015	1	17
Average							13		1		1	13
Overall Average							13		1		2	15

Figure 12. Army AoA Process (Recent AoAs).

While 5APPENDIX H has more detailed information on the 10 most recently completed Army AoAs analyzed to gather insights and collect statistics, Figure 12 above provides some of the data used to provide statistics on the AoA duration. While the chart above uses the time from the first SAG to the completion of the Final Report as one measure of AoA length, it should be pointed out that CAPE considers the AoA length to be the time from the first SAG to the Final Brief.

As discussed in several sections of this report, there are quite a few factors that contribute to the length of a given AoA. APPENDIX H details some specific causes found in our case studies. As mentioned in the introduction, our analysis of the 10 AoAs found the average study length to be 13 months (using the Army's definition for duration). The duration should be shorter using CAPE's definition.

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5 CHALLENGES AND RECOMMENDATIONS

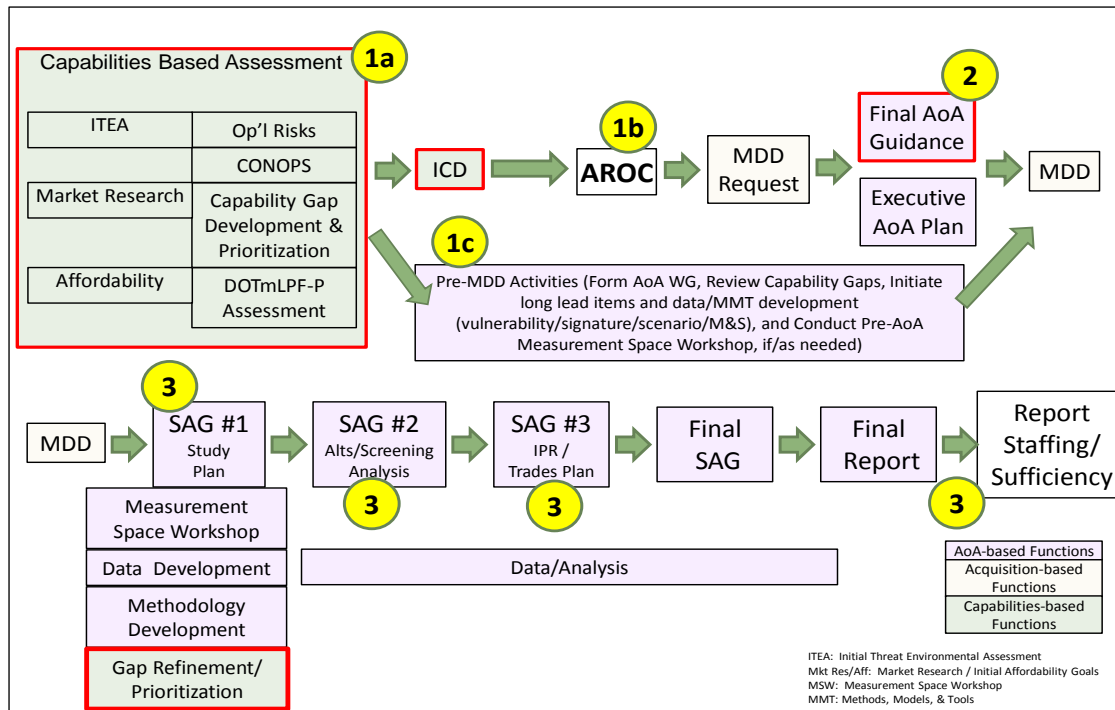


Figure 13. Related AoA Process Activities.

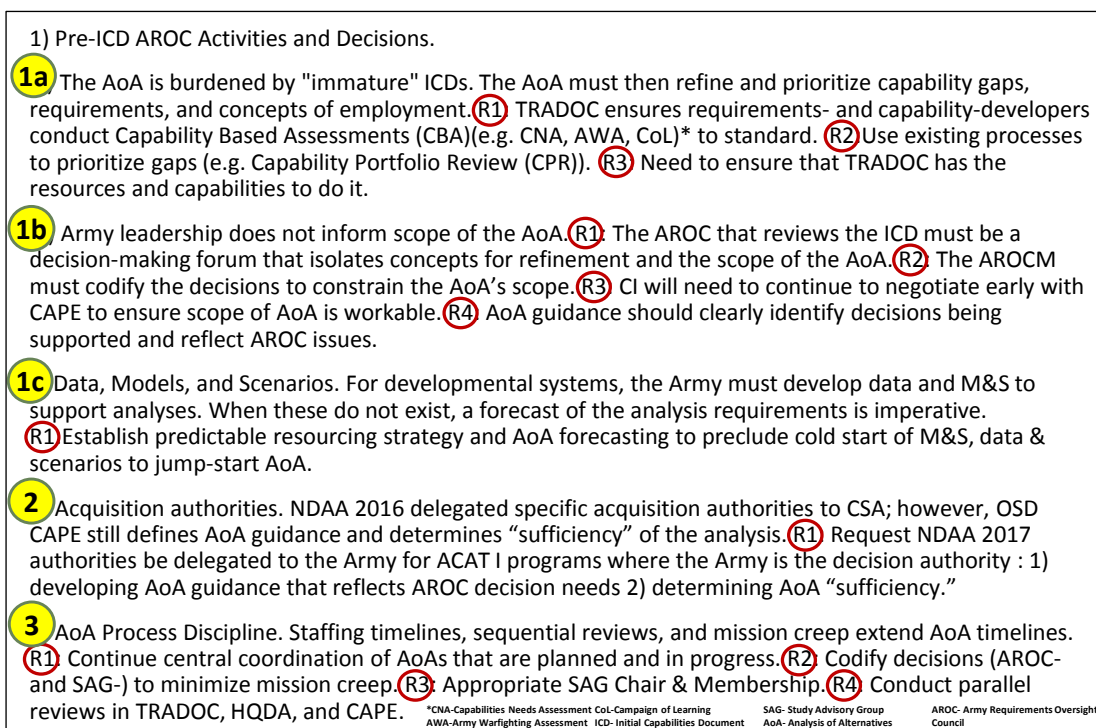


Figure 14. Challenges and Recommendations.

The first three recurring challenges are under what we describe as Pre-ICD AROC Activities and Decisions. This is the area believed to be the biggest payoff to make the AoA process more efficient and effective.

The first challenge (labeled 1a in Figure 13 and Figure 14) has been that many of the analytical products that should underpin the ICD and support the kickoff of the AoA haven't been done or are insufficient to inform the start of the AoA. The AoA then has had to develop these "in-stride" with the analysis. Organizational and operational concepts and employment TTP are often absent or immature. The AoA then concurrently underpins requirements and refines gaps. Lessons learned show that weak and/or unsupportable requirements documents and initiation of the AoA with insufficient information on the technology, requirements, and concepts of employment to conduct an evaluation can add 6 months or more to the timeline. The first recommendation is for TRADOC to ensure that requirements and capability developers conduct CBAs to standard. (The Army uses CNAs, AWAs, and CoLs to constitute the CBAs with some special CBAs done by the CoEs. A second recommendation is to ensure that TRADOC has the resources and capabilities needed to do the CBA, especially the right human capital. A third recommendation is to use existing processes such as the CPR to allow Senior Leaders to emphasize (prioritize) gaps to inform resourcing for CBAs. The acquisition and S&T communities have a role here and can help. A prioritization could help direct their efforts.

A second perceived challenge (labeled 1b in Figure 13 and Figure 14) has been that the Army Leadership hasn't had the opportunity to inform the scope of an AoA. While a paper AROC has always been in use, it is perhaps not the best forum for divining Senior Leader questions and scope guidance. Utilizing the revitalized AROC process for ACAT I programs to gain Army guidance early and nail down AoA scope in an AROC Memorandum should greatly inform the process. Since CAPE still maintains oversight of the AoA guidance and study plan for ACAT I programs, G-3 CI will need to continue to negotiate with CAPE early to ensure that the AoA scope remains workable and guidance reflects AROC issues.

For developmental systems, there are many items that take a long lead time to develop – such as vulnerability, signatures, threat/foreign systems data, as well as M&S modifications that may be necessary to model new behaviors and new scenarios that need to be developed (challenge 1c). If the Army hasn't invested in the previous FY to get these things done, the next FY will encounter scheduling delays to do these. So a forecast of the analysis requirements is imperative along with the dedicated funding necessary to support these activities. The dedicated funding now established to support TRAC/AMSAA is allowing pre-MDD activities to get started.

The second challenge area has to do with acquisition authorities. While the 2016 NDAA delegated some acquisition authorities to the Service Chiefs, the WSARA still vests CAPE with the responsibility for AoAs of MDAPs, regardless of delegation. Without further authorities for ACAT I systems, CAPE still retains authorities to write guidance and determine AoA "sufficiency"--they still hold the trump card. This may not give us the biggest bang for the buck in terms of process reform. While this may add some efficiencies to the timeline, there are benefits to CAPE retaining oversight (buy-in, checks and balances, and better Joint collaboration).

The final challenge area has to do with discipline in the AoA process. This is another big potential payoff area. The first recommendation has to do with continuing central coordination of AoAs planned and in progress. The second is to codify decisions from either the SAG or the

AROC to minimize mission creep. Mission Creep -- additional study issues or desired expansion of the analysis representing a special interest and not directly related to the milestone decision, can increase AoA timeline (1 to 6 months). SAGs/AROCs should not revisit previously discussed topics/decisions. All SAG objectives should be decision points and clearly defined upfront. Having the appropriate chair and the appropriate membership has been a finding in many of the AoA reviews. The chair must have sufficient gravitas to maintain control of the SAG and have sufficient analytical skills to understand the implications of any proposed study questions or potential expansions on the analysis. Ensuring that you have all the right stakeholders, both inside and outside the Army, can alleviate concerns or delays down the road. If HQDA and TRADOC conduct reviews in parallel, the Army can greatly shorten the AoA staffing timeline.

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APPENDIX A PROJECT CONTRIBUTORS

A-1 PROJECT TEAM

Project Director: Renee G. Carlucci

Team Members: Nancy Zoller

A-2 PRODUCT REVIEWERS

Mr. Russell Pritchard, Quality Assurance

A-3 EXTERNAL CONTRIBUTORS

James Amato

Lorraine Anderson

Morteza Anvari

Aivars Baumanis

Lindsay Bear

Peter Bechtel

Ken Bernier

Pamela Blechinger

Robert Bowen

Nancy Bucher

Sherdina Calloway

Mark Caskey

Darrell Collins

Scott Comes

John Daniels

Debra Davis

Frank Decker

Thomas Dillingham

John Duke

Robert Dyess

Steffanie Easter

Edelmiro Escobedo

Cory Faison

Christopher Farrell

John Ferrari

Wilton Ham

David Henningsen

Joann Holland

Annette Jones

James Judy

William Kaczynski

Keith Kaspersen

Krystyna Kolesar

Edward Koucheravy

Garrett Lambert

Larry Larimer

Michael Lebrun

Kenneth Lenig

Rebecca Mackoy

Vincent Malone

Gregory Mannix

David Markowitz

Bonnie Mcilrath

Suzanne Milchling

Michael Moore

David Payne

Bradley Pippin

James Schirmer

George Seaward

Julia Sharkey

Stephen Shuster

Richard Stewart

UNCLASSIFIED

CAA-2016058

David Thomen

Michael Thurston

Alison Tichenor

Donald Tison

Sean Vessey

Sarah Webster

Charity West-Garvin

Camilla White

Stephen Wills

Alfred Wilson

John Wilson

Cedric Wins

Mark Young

Nicholas Zello

APPENDIX B REQUEST FOR ANALYTICAL SUPPORT

REQUEST FOR ANALYTICAL SUPPORT

Performing Division: RA		Account Number: 2016058	FY: 2016
Acronym: AoA PI		Start Date: 24-Mar-16	Est Compl Date: 29-Apr-16
Title: Analysis of Alternatives (AoA) Process Improvement (PI)			
Category: Material Systems and Acquisition Resource Analysis			Method: In-house
Sponsor (e.g., DCS-G3) Name: DCS-G8 Other		Office Symbol: DAPR-ZA	
Phone:	E-Mail: donald.c.tison.civ@mail.mil	POC: Mr. Don Tison	
Resource Estimates:	a. Estimated Hrs: 200	b. Estimated Funds:	
Models to be Used:		Product: Briefing and Report	
Description/Abstract: This is a 30-day study to help the Army determine how to shorten the timeline for accomplishing an Analysis of Alternatives (AoA). AoAs are an important part of the Army acquisition process. However, the current timelines for completing an AoA are a contributing factor to the very long lead times needed for Army acquisition programs.			
Study Director/POC Signature: <i>Renee G. Carlucci</i>		Phone: 703-806-5617	
Study Director/POC: Ms. Renee G Carlucci			
PART 2			
Background/Statement of Problem: LTG Murray, Deputy Chief of Staff G-8, requested a short 30-day review to determine how to shorten the AoA timeline. This study led by CAA will include many of the Army and OSD players involved in the AoA process.			
Scope: The effort will address: (1) Prioritization of AoAs, (2) Scope/M Measurement Space: "As Is" process mapping, "To Be" process mapping, Examination of historical case studies, Utilization of TRAC's AoA Primer and previous acquisition reviews, (3) Study Directive/AoA Guidance Development, (4) Technical Review (Study Advisory Group (SAG)) Process: Requirements and gaps, Scope/M Measurement Space, Results, (5) Funding, and (6) Options for who/what office should synchronize AoAs for the Army.			
Issues:			
Milestones: Initial Scoping Session, 25 March 2016. Weekly AoA PI SAG meetings via telecom or VTC.			
Signatures	CAA Division Chief Signature: <i>Renee G. Carlucci</i>		Date 25 Mar 16
	CAA Division Chief Name: Ms. Renee G Carlucci		
	Sponsor Concurrence Signature: <i>Don P. Tison</i>		Date 25 Mar 16
	Sponsor Name (COL/DA Div Chief/GO/SES): Mr. Don Tison		

Print Date: 25-May-16

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APPENDIX C LITERATURE REVIEW/REFERENCES

U.S. Code USC Title 10, Section 2366a: Major Defense Acquisition Program: Certification Required Before Milestone ‘A’ Approval

Public Law 111-23 Weapon Systems Acquisition Reform Act (WSARA) (22 May 2009): introduced statutory requirements to conduct AoAs along with introduction of the Joint Staff in reviewing the final results of AoAs.

National Defense Authorization Act for Fiscal Year 2016 (NDAA 2016): pushed authorities for acquisition decision down from Office of the Secretary of Defense (OSD) to the Services, the NDAA 2016 also retained the requirement for OSD to develop AoA study guidance and to evaluate AoAs for sufficiency at completion.

Department of Defense Directive (DoDD) 5105.84 (dated May 11, 2012)

Department of Defense Instruction (DoDI) 5000.02 Subject: Operation of the Defense Acquisition System (dated January 7, 2015)

CJCSI 3170.01I Joint Capabilities Integration and Development System (23 JAN 2015)

Manual for the Operation of the Joint Capabilities Integration and Development System (JCIDS) (12 FEB 15)

Government Accounting Office, GAO-09-665, Many Analyses of Alternatives Have Not Provided a Robust Assessment of Weapons Systems Options, September 2009.

Army Regulation 70-1 Army Acquisition Policy (Research, Development, and Acquisition) (22 JUL 11)

Army Regulation 71-9 Warfighting Capabilities Determination (Force Development) (28 DEC 09)

TRADOC Regulation 71-20: Concept Development, Capabilities Determination, and Capabilities Integration (Force Development) (28 JUN 13)

Defense Acquisition Guidebook, <https://dag.dau.mil>

Defense Acquisition University (DAU) Analysis of Alternatives (8 Dec 2015)

“Army Strong: Equipped, Trained and Ready”, Final Report of the 2010 Army Acquisition Review (Decker/Wagner)

TRAC AoA Primer

ARCIC Comparative Analysis Assessment Matrix Information Paper

CAPE AoA Assessment, August 2013

Re-engineer Army Process for “Analysis of Alternatives” Studies, Coordination Draft, John Riente, 18 Sep 1998

AMSAA AoA Lessons Learned, April 2016

Analysis of Alternatives (AoA) Review, AMSAA, ARCIC, TRAC, May 2011

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Improving U.S. Army Analysis of Alternatives to Better Address the Weapon Systems Acquisition Reform Act Of 2009, Senior Service College Fellowship, Thomas Stadterman, May 2012

Analysis of Alternatives Focused Business Case Analysis Final Report 1.30.14, Headquarters, Air Force/Studies, Analyses and Assessments (A9), Jan 2014

APPENDIX D KEY DEFINITIONS/TERMS

AIS: Automated Information System

AoA Analysis of Alternatives

AROC Army Requirements Oversight Council

AROCM Army Requirements Oversight Council Memorandum

ASARC Army Systems Acquisition Review Council

CAPE Cost Assessment and Program Evaluation

CBA Capabilities-Based Assessment

CDD Capability Development Document

CJCSI Chairman of the Joint Chiefs of Staff Instruction

CNA Capabilities Needs Analysis

CPD Capability Production Document

DAE Defense Acquisition Executive

DOTMLPF-P Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities, and Policy

EMD Engineering and Manufacturing Development (phase)

ICD Initial Capabilities Document

ICDT Integrated Capability Development Team

IPL Integrated Priority List

JROC Joint Requirements Oversight Council

JUON joint urgent operational need

KPP Key Performance Parameter

KSA Key System Attribute

M&S Models and Simulations

MAIS Major Automated Information System

MDA Milestone Decision Authority

MDAP Major Defense Acquisition Program

MS Milestone

MS A Milestone A: Approval that the Materiel Solution Analysis (MSA) Phase is complete and permission to enter the Technology Maturation and Risk Reduction (TMRR) Phase.

MS B Milestone B: Approval that the TMRR phase is complete and permission to enter the Engineering and Manufacturing Development (EMD) Phase.

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MS C Milestone C: Approval that the EMD phase is complete and permission to enter the Production and Deployment (PD) Phase.

MSA Materiel Solution Analysis (phase)

NDI Non-Developmental Item

TD Technology Demonstration

APPENDIX E HIGHLIGHTS FROM LITERATURE REVIEW AND ORGANIZATION LESSONS LEARNED

E-1 Lessons Learned: TRAC, 2016

- Problem: Weak and/or unsupportable requirements documents -- resulted in increased AoA timelines (3 to 6 months) to refine capability gaps and supporting analyses. Recommended Solution: revitalized AROC and foundational work/requirements development done to established standards.
- Problem: Mission Creep -- additional study issues or desired expansion of the analysis representing a special interest and not directly related to the milestone decision can increase AoA timeline (1 to 6 months). Recommended Solution: Ensure study is scoped to address the specific decision issues and special interests are kept out of the study.
- Problem: Staffing Delays* – Redundant staff actions and staffing in sequence can extend AoA timelines (6 to 9 months). Recommended Solution: New authorities now can allow Army to eliminate some staff redundancy (e.g. when Army has lead for an AoA). Parallel staffing vice sequential can also reduce the staffing time.
- Problem: Premature AoA Initiation – initiation of the AoA with insufficient information on the technology, requirements, and concepts of employment to conduct an evaluation could add 6 months or more to the timeline. Recommended Solution: Maintain established standards for conducting Capability Based Assessments (CBAs) and market research prior to AoA initiation.

Figure E-1. Obstacles to Timely AoAs: TRAC, 2016.

E-2 Lessons Learned: ARL/SLAD, 2016

- Long Lead Items
 - Vulnerability
 - Scenario Development
 - Model Development
 - Signatures
 - Threats/Foreign Systems Data (Characteristics, Performance, Cost, Prevalence)
 - Capability Gap Identification
- Mission Creep- In part due to SAG attendance inconsistencies and revisiting previous SAG decisions
- Data Availability of Systems

Figure E-2. Obstacles to Timely AoAs: ARL/SLAD, 2016.

E-3 Lessons Learned: AMSAA, Apr 2016

- | | |
|--|---|
| <ul style="list-style-type: none"> • Based on After-Action Reviews of 11 post-WSARA Army AoAs • Influence study planning early by providing inputs to study Guidance <ul style="list-style-type: none"> • Guidance development should include study representatives • Study lead determination process should be standardized • Understanding of Capability Gap Development to inform AoA timeline • Standardize SAG Process <ul style="list-style-type: none"> • Reduce study creep by limiting expanding guidance at each SAG • Alternatives need to be set early in SAG process (1st or 2nd) • Need clear community understanding and impacts of tasks coming out of SAGs • Address inconsistency in attendance issues to ensure previous SAG decisions are not revisited • Identify PM and RDEC Representatives Upfront | <ul style="list-style-type: none"> • Data collection • Workshop Participation • RFIs (when applicable) • Support Pre-MDD Analysis of Long lead Items to support emerging AoAs <ul style="list-style-type: none"> • Vulnerability • Scenario Development • Model Development • Signatures • Threats/Foreign Systems Data (Characteristics, Performance, Cost, Prevalence) • Capability Gap Identification • Ensure OSD and Army involvement/awareness outside of SAGs <ul style="list-style-type: none"> • Measurement Space Workshop participation • Data Deep Dives • Capability Gap Reviews |
|--|---|

Figure E-3. Lessons Learned: AMSAA, Apr 2016.

E-4 Recommendations, Defense Acquisition University, May 2012

- The Army AoA community and OSD CAPE should build a closer working relationship.
- AoAs should focus on the decision choices and the decision space.
- AoAs should identify an achievable, affordable, and operationally relevant set of attributes.
- The focus of foreign systems should be to investigate features, capabilities, attributes, feasibility, and cost.
- The Army should create a formal analytical process that supports MS decisions, requirements development, materiel acquisition, and portfolio management throughout the acquisition process.

Figure E-4. Recommendations, Defense Acquisition University, May 2012.

E-5 Lessons Learned: TRAC, ARCIC, AMSAA AoA Review, May 2011

- The resultant exploratory nature of the tasked AoA is often at odds with its due date.
- The lack of industry input to the Materiel Solution Analysis (MSA) Phase limits the relevance of the knowledge and data about materiel solutions (technologies) used in the MS A AoA that are sourced largely from the government.
- Full consideration of NDI or foreign alternative solutions can be complicated by the lack of authoritative agreements to transfer data, by untimely availability and incompleteness of technical data, and/or by the lack of clear government responsibilities to obtain and make that data available to the AoA.
- Treating particular tech demo (TD) candidates offered by industry as specified AoA alternatives (an interest of OSD) may pose legal issues WRT source selection. It certainly complicates timely AoA use of vetted and validated data collected during the concurrent demo.
- The numbers, scope of effort and suspenses of AoAs are dictated with little regard for the Army's finite capacity to produce them.

Figure E-5. Lessons Learned: TRAC, ARCIC, AMSAA AoA Review, May 2011.

E-6 Lessons Learned: GAO Report, Sep 2009

- Reviewed 32 Programs from all Services
- Most of the programs reviewed either did not conduct an AOA or conducted an AOA that focused on a narrow scope of alternatives and did not adequately assess and compare technical and other risks of each alternative.
- Found that the programs that considered a broad range of alternatives tended to have better cost and schedule outcomes than the programs that looked at a narrow scope of alternatives.
- Factors limiting the effectiveness of AOAs and their ability to identify the most promising option and contribute to a sound business case for starting a weapon system program: (1) service sponsors lock into a solution early on when a capability need is first validated through DOD's requirements process and before an AOA is conducted; (2) AOAs are conducted under compressed time frames in order to meet a planned milestone review or fielding date and their results come too late to inform key trade off decisions; and (3) DOD does not always provide guidance for conducting individual AOAs.

Figure E-6. Lessons Learned: GAO Report, Sept 2009.

E-7 Decker-Wagner (Army Acquisition Review) Findings, Jan 2011

- The mean time to approve an Acquisition Category (ACAT) I system requirement is 15 months with an ACAT II taking 22 months and an ACAT III taking 18.
- Common causes of major program cancellation include:
 - Overly optimistic forecast of funding available for Army modernization.
 - Weak baseline, modeling, trade studies or analysis of alternatives.
 - Unconstrained weapon system requirements.
 - Underestimation of risk, particularly technology readiness levels.
 - Failure to eliminate technological risk prior to Milestone B (MS B) approval.
 - Program skipped or under-resourced pre-MS B prototyping.
 - Too many programs started only to prove unaffordable in the budget and Future Years Defense Program (FYDP).
 - Affordability reprioritization.
 - Schedule slip.
 - Requirements and technology creep.
 - Cost overruns.
 - Program restructured, quantities cut, unit costs skyrocketed and program support lost.
- Solutions:
 - Make Requirements Process Collaborative and Timely - Army Regulation (AR) 71-9 provides for collaborative requirements development with an Integrated Capabilities Development Team (ICDT). Unfortunately, TRADOC has no authority to require participation, but can only “invite” those who choose not to participate and will later critique the requirement.

Figure E-7. Decker-Wagner (Army Acquisition Review) Findings, Jan 2011(1 of 2).

A TRADOC-led Integrated Capabilities Development Team (ICDT) with personnel from the Army Staff (ARSTAFF) and Secretariat, Army Materiel Command (AMC), Army Test and Evaluation Command (ATEC) and other Army Commands *should* collaboratively develop requirements documents for AROC approval of most programs: – Amend Army Regulation (AR) 71-9 to give the TRADOC commanding general (CG) the authority to task non-TRADOC organizations for ICDT participation. ICDT representatives must have the authority to speak for and commit their organizations.

TRADOC and Army requirements approval, MDD, MS A and MS B decisions must be synchronized to align with the Army POM and budget development schedules.

The study authors found the Army’s documented reasons for cancellation to be too general and in conflict with the facts as they knew them based on personal experience with many of the 22 programs and discussions with others in the Army who had worked on the programs. There are typically multiple causes for each program cancellation, and for each program conflicting explanations. Although there are many different causes that contribute to the cancellation of a program, the cancelled programs often shared several of the same problems. A few were cancelled because the threat disappeared. Yet the reason most often cited for program cancellation was tersely described as a ‘change in priorities’ or ‘affordability’.

- Conduct competitive prototyping at the component, subsystem and even system level prior to EMD to reduce technical, schedule, cost and performance risk.
- Increase the number of qualified systems engineering, cost estimating, quality assurance and ORSA (military FA 49 and civilian 1515) personnel in Army acquisition.
- Leverage FFRDCs and UARCs to make up for the shortfalls in the Army's systems engineering, quality assurance and analytic capabilities until the bench is replenished.
- Increase both AMSAA and TRAC funding by \$10M per year to conduct AoAs.
- Continue to resource the DA program for data collection and development of scenarios, models and simulations to support requirements development.
- Develop needed analytic portfolio management tools for the G-8 and CPRs.
- In the past, the analytic support and backup for the VCSA's and other Army Staff (ARSTAFF) reviews and decision bodies came from the Deputy Under Secretary of the Army (Operations Research) (DUSA(OR)), but this position was eliminated in 2006. The DUSA(OR) was the spokesman for Army studies, analyses and testing within the Army and with DoD.
- With the elimination of this position, the Army lost its single independent voice across the Army, in the JCS, at OSD and on the Hill for ORSA, requirements, prototyping, experimentation, and testing.
- The root causes for troubled and terminated programs usually stem from the developmental planning period from before MDD to Milestones A&B.
- In addition to a timely and productive requirements development capability, Army acquisition must have its own organic capability to lead pre-Milestone A advanced systems concept formulation, explore promising advanced technology concepts, and conceive and advocate advanced programs before there is a Program Manager assigned;

Figure E-8. Decker-Wagner (Army Acquisition Review) Findings, Jan 2011(2 of 2).

Numerous acquisition studies and DoD directives have recommended competitive prototyping at the component, subsystem, and even system level prior to EMD to reduce technical, schedule, cost, and performance risk. Pre-EMD subsystem and system prototyping were a major benefit in many of the successful programs studied. Unfortunately, acquisition strategies too often omit this in order to shorten the schedule and lower development cost, only to result in more development time and cost due to technical problems during EMD that could have been prevented with competitive prototyping. Similarly, during development many programs do not invest sufficiently to reduce eventual life cycle costs.

E-8 The Joint Capabilities Integration and Development System (JCIDS) Review – Goldwater Nichols Analysis Working Group

Requirements Reform Recommendations

- ❑ **Recommendation: Establish core elements required for developing Capability-Based Assessments (CAPE-led Analysis Working Group)**
 - Bolster up-front analytical rigor to decisions impacting materiel solutions
 - Core elements: study advisory group with external stakeholders charged with ensuring analytic sufficiency by issuing study guidance, vetting threat projections, approving study plans, and identifying affordability issues, as appropriate
- ❑ **Recommendation: “Develop Middle Tier” Requirements Lane (JS-led Working Group)**
 - Support CCMD needs which don’t meet urgency criteria or fielding timelines of JUON/JEON to “middle tier”
 - Develop Rapid Requirements Document: hybrid between JUON and ICD (content and staffing); eliminate JEON; enables rapid prototyping/rapid fielding to meet “emergent military needs”
 - Develop Agile-Capability Development Document: leverage the Information Systems-Capability Development Document model to streamline requirements process, delegate requirements approval authority
- ❑ **Recommendation: Analytical Expertise of the Requirements Community (JS/CAPE Working Groups)**
 - Expanded human capital is needed to improve analytical expertise for the identification, assessment, and approval of requirements
 - National Defense Authorization Acts 2015, 2016 and engagements with Congress reveal intent to expand the analytical rigor to requirements, acquisition and resourcing determinations with specific emphasis in operations research and systems engineering

Figure E-9. Goldwater Nichols Requirements Reform, 2 Mar 16.

The JCIDS Review Goldwater Nichols Analysis Working Group was comprised of members from the Joint Staff, the Services, CAPE, AT&L, and Director, Operational Test and Evaluation (DOT&E). The groups’ goal was to set a strong foundation to enable effective acquisition program development and progress toward successful production and fielding. Their focus was on optimizing analytic rigor in the CBA and other studies used to identify capability requirements and gaps. Their approach was to establish a CBA process baseline, conduct a case study review of recent CBAs (CAPE reviewed nine CBAs), and to determine lessons learned, good practices, and pitfalls to avoid. The figure above highlights the key recommendations from the effort. However, many of their observations echo findings from our AoA review (e.g., some CBAs were insufficient for informing ICDs and supporting AoAs). They recommend the use of external stakeholders to help improve CBAs, providing better ICDs and AoAs and to help reduce CBA/AoA cycle times and the use of SAGs as are used in AoAs. They caution against specifying performance attributes too narrowly or without analytical justification, which can limit trade space.

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APPENDIX F PROCESS MAPS

F-1 Integrated Army Decision Support System

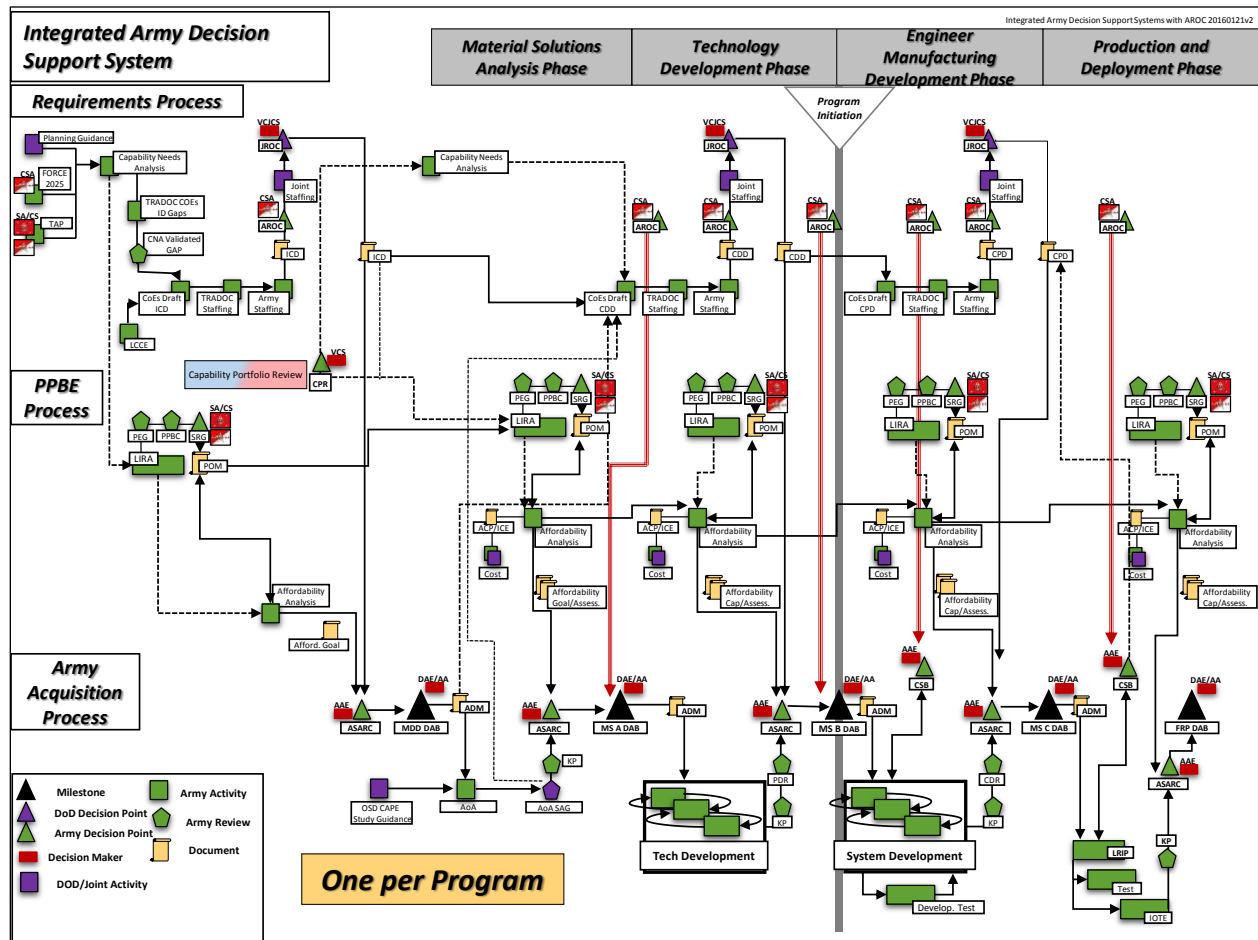


Figure F-1. Integrated Army Decision Support System Process Map.

F-2 Deliberate Requirements Process

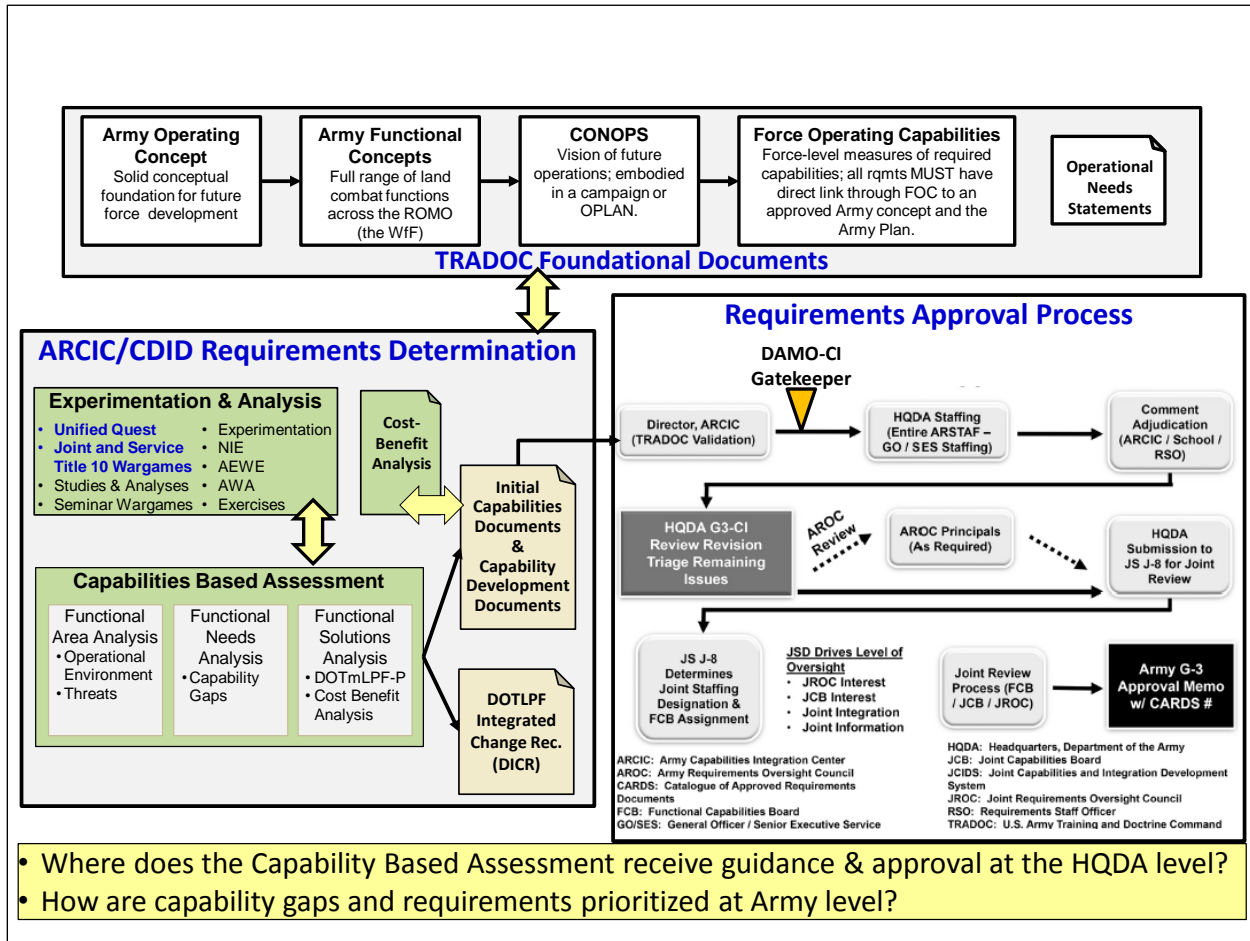
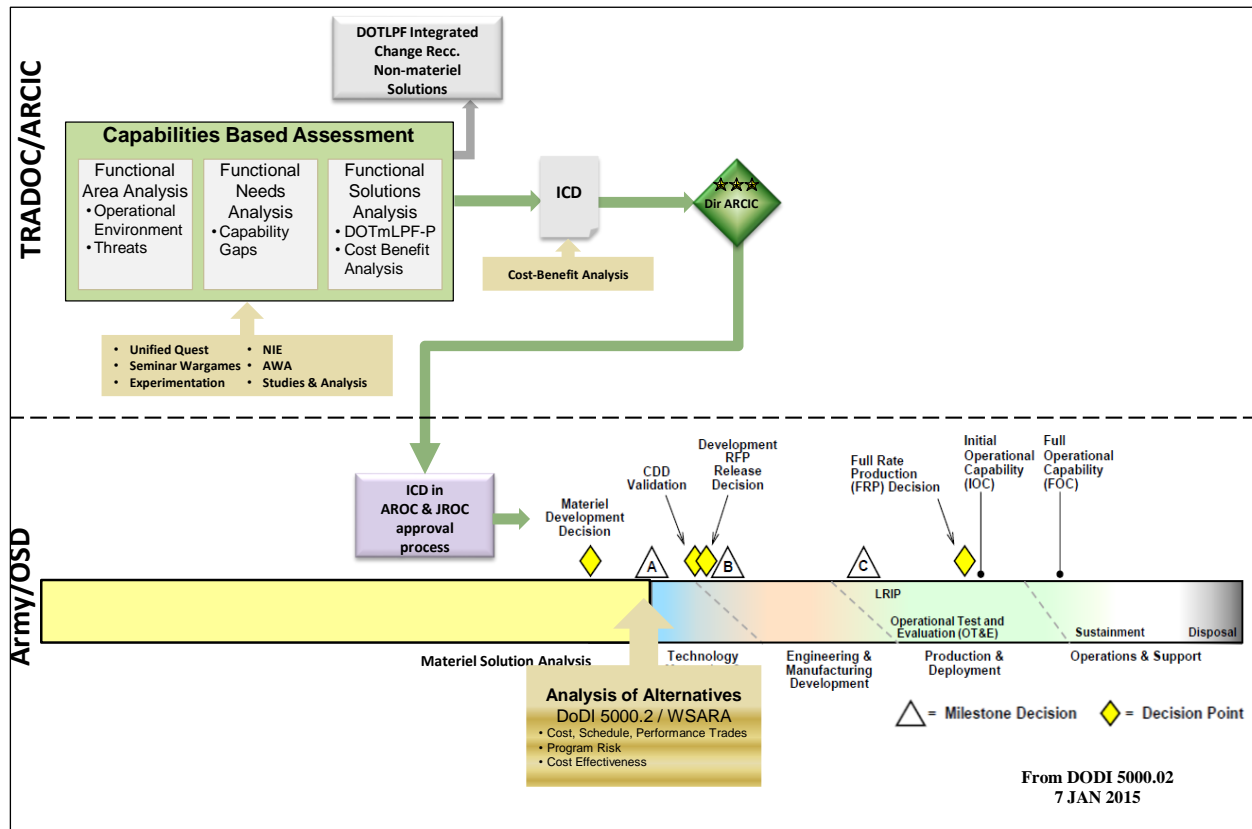
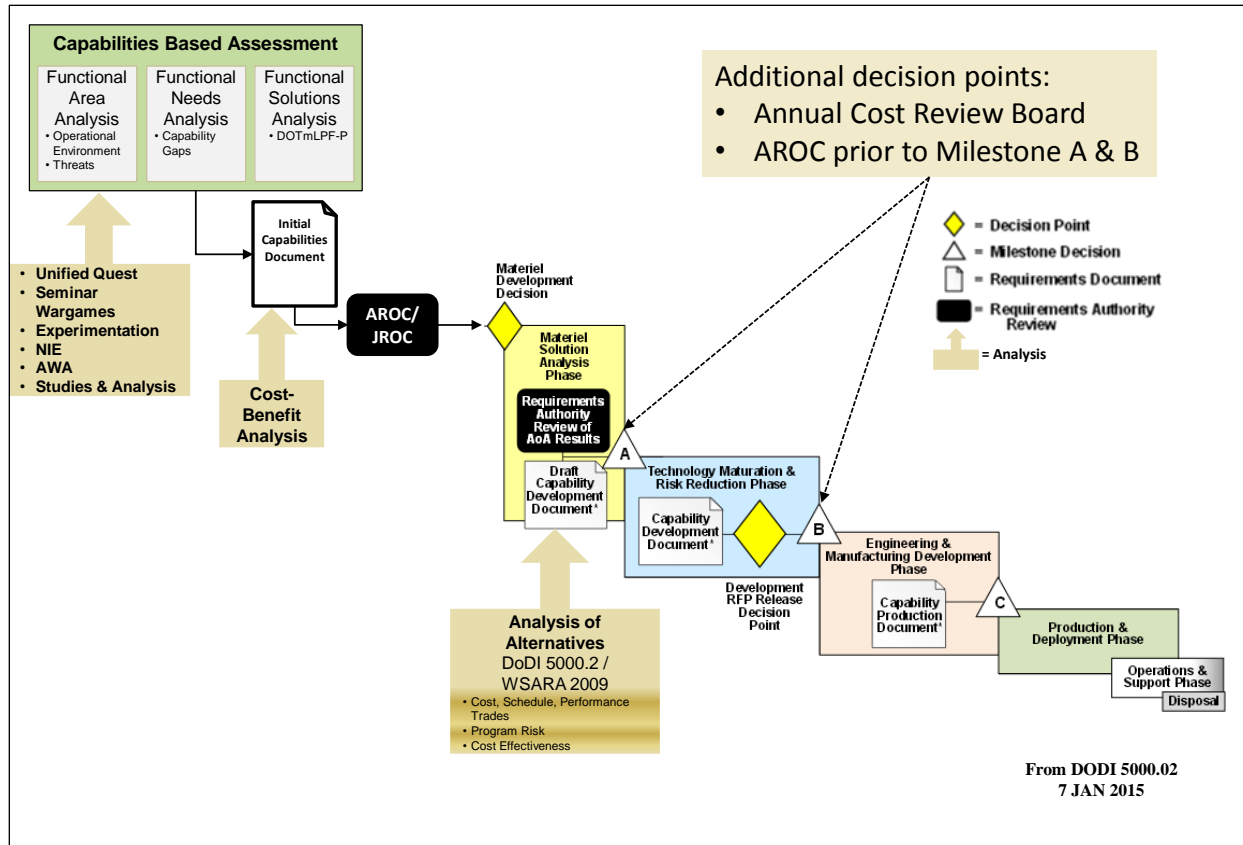


Figure F-2. Deliberate Requirements Process.

F-3 Process as Designed—ACAT I Programs



**Figure F-3. Process as Designed
ACAT I Programs.**



**Figure F-4. Process as Designed- Additional Decision Points
ACAT I programs.**

F-4 Capabilities Needs Analysis (CNA) Process

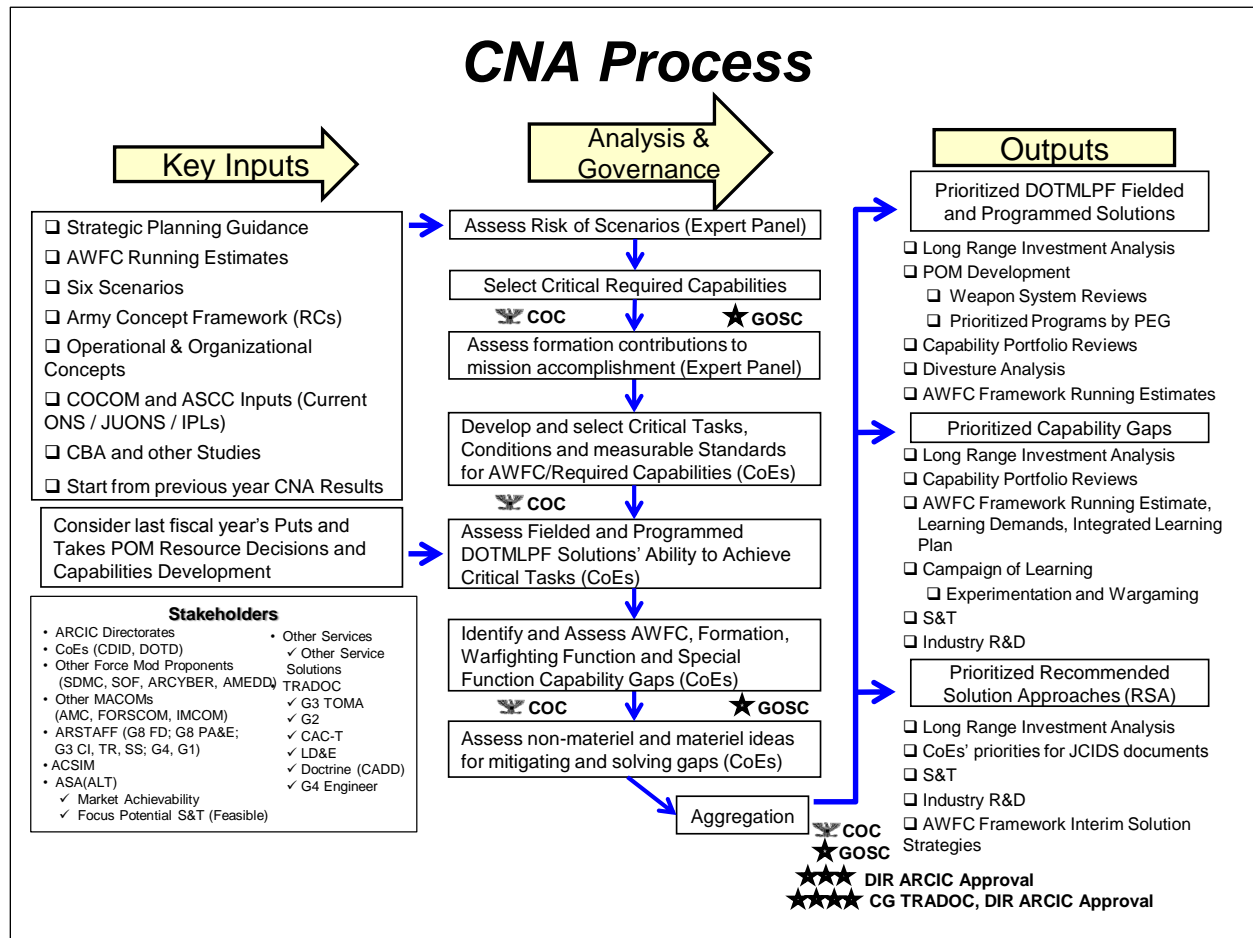


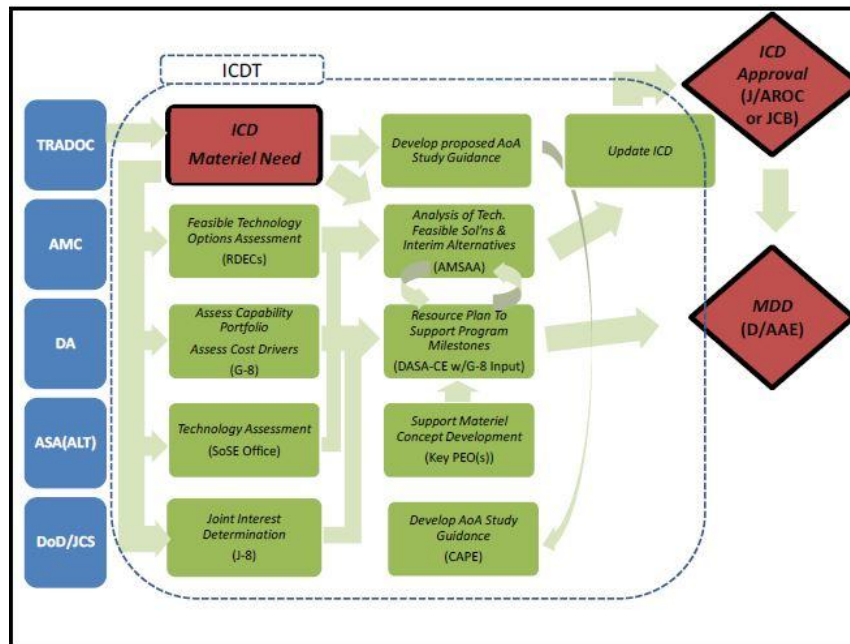
Figure F-5. Capabilities Needs Analysis Process.

The key inputs to the CNA process include: scenarios, concepts (specifically the required capabilities), operational and organizational concepts as they're developed.

The CNA objective was established to meet the ARCIC Director's intent. It was developed considering the context of the Army Operating Concept, Army Warfighting Functional Concepts on how to fight in the future, and five Support to Strategic Analysis compliant scenarios to enable prioritization of Resourcing and Developments through a capability-based analysis across Warfighting Functions as well as Formations. This objective was decomposed into 3 issues and 11 essential elements of analysis to help understand the extent of the problem set needed to answer the CNA objective. In essence, the CNA must determine preferences in three areas. First, determine the ordered preference of which of the current programs to sustain in the force or programmed budget to ensure the Army meets its joint warfighting requirements and which can be traded-off with minimal risk to enable procuring a new capability that mitigates or solves a high risk gap. Second, determine which of the tasks representing the Army's Warfighting Requirements cannot be achieved, describe the capability gap that results and assess the operational risk of that gap in the scenario set. This provides an ordered preference for which gaps to address soonest. Third, determine an ordered preference for the solutions that solve or mitigate the gap to enable future investment focus.

So then the next step was to determine how to represent all of these competing objectives in a cohesive analysis that would account for all stakeholder and Force Modernization Proponents equities.

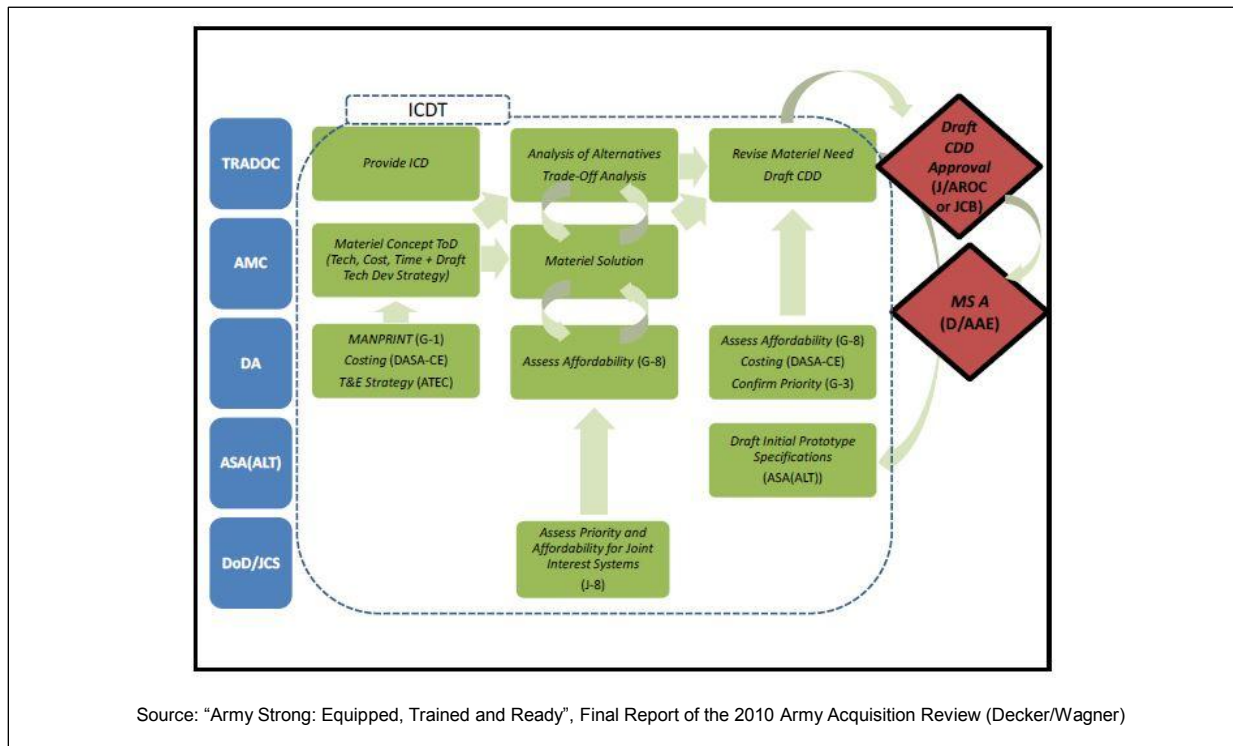
F-5 High Level Process Map (ICD to MDD)



What are the analytical activities supporting requirements development?

Source: "Army Strong: Equipped, Trained and Ready", Final Report of the 2010 Army Acquisition Review (Decker/Wagner)

Figure F-6. High Level Process Map (ICD to MDD).

F-6 High Level Process Map (MDD to MS A))**Figure F-7. High Level Process Map (MDD to MSA).**

F-7 High Level Process Map (MS A to MS B)

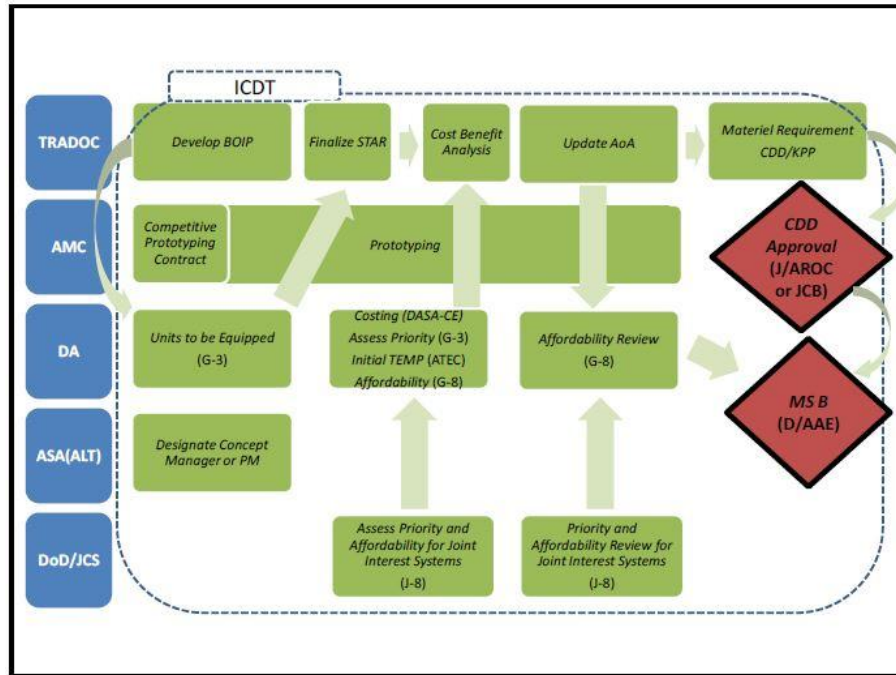


Figure F-8. High Level Process Map (MS A to MS B).

F-8 AoA Related Process Activities

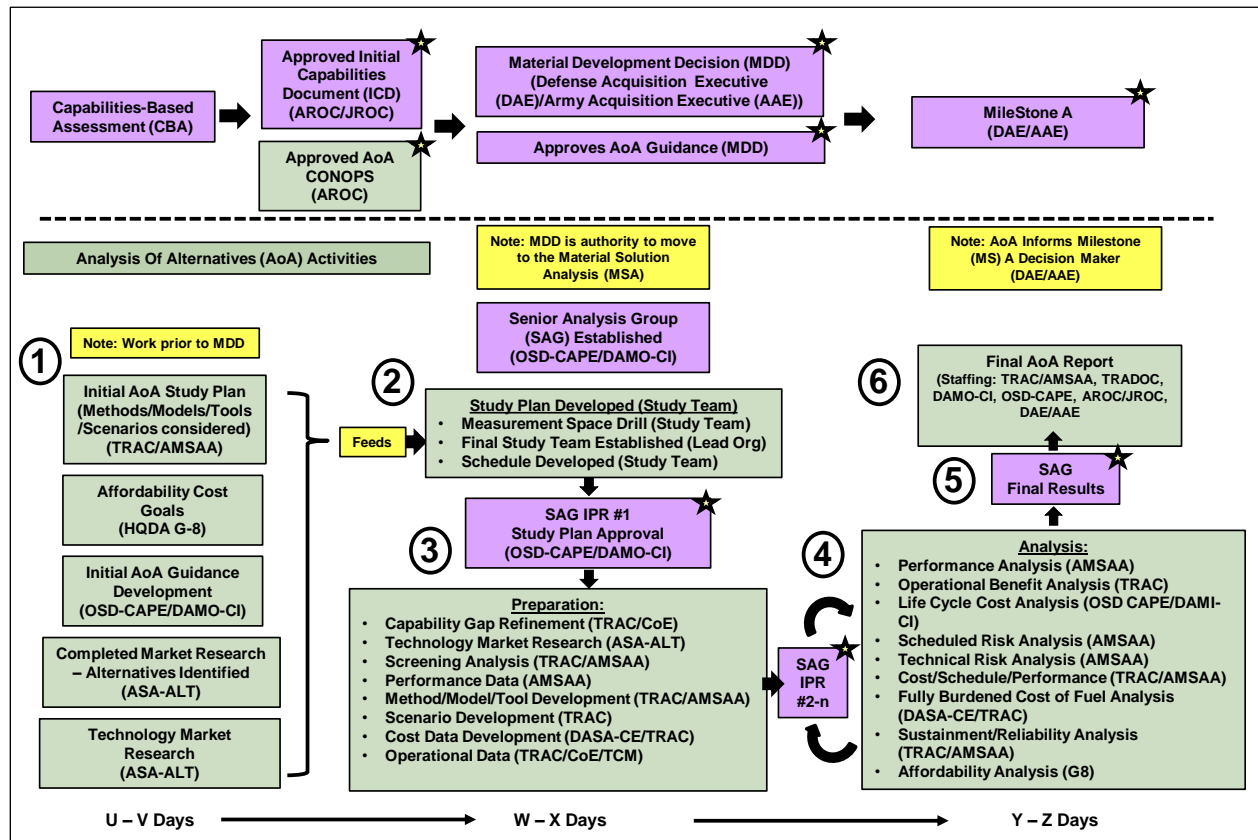


Figure F-9. AoA Related Process Activities.

F-9 ACAT I AoA Process Steps

INDEX	Input	Activity	Lead Agency	Output	Comments	Predecessor	Duration
0	CBA/CNA -->ICD	AoA work planning Forecast	DAMO-CI	Develop proposed work plan for AoAs coordinated with Study Agencies	Allows Study Agencies to do initial work planning for forecast AoAs.	Approved CBA	Quarterly
1	CBA/CNA -->ICD	AROC/JROC	TRADOC CoE/DAMO-CI	ICD Approval	Provides the foundation for all future analysis/assessments	Approved CBA	
2	AROC/JROC Decision	MDD Request	DAMO-CI/ASA(ALT)	MDD Scheduled		0, 1	1-3 mo
3	MDD Request	AoA Guidance Developed/Finalized (signed)	DCAPE/DAMO-CI	Guidance Directive/Document	Approved at the MDD, sets initial scope of the study	2	1-3 mo
4	MDD Request	AoA Study Plan Development	TRAC/AMSAA/AoA Lead Agency	Executive Level Study Plan (i.e., 10 pager required in guidance)	Done in conjunction and coordination with AoA guidance development; executive level plan	0, 2	1-3 mo
5	MDD Request	Affordability Cost Goals Developed	G-8	Cost Goals input to Study	Provides APUC, lifecycle training and sustainment goals	2	1-3 mo
6	AoA Guidance	MDD Decision	DAE/AAE	Authority to enter MSA Phase and conduct AoA	ASARC Memo or ADM	3,4,5	1 mo
7		Capability Gap Refinement	TRAC/Proponent CoE/TCM	Understanding and refinement of the capability gaps to enable analysis of means to mitigate the gaps	ICD, This is done routinely as a first step in AoAs, but should be done in the CBA process	3	1-6mo
8		Measurement Space Drill	AoA Lead Agency/ TRAC	Methods, Models, Tools, and Scenarios identified to conduct the study, full study team identified (roles/responsibilities), tasks issued, schedule developed, study scoped to tipping point issues	Provides Key Input for Detailed study plan and execution plan. Foundation for AoA data/alternative RFI	3,4,5,7	1-3 wks
9		Study Plan Approval SAG IPR 1	DCAPE/DAMO-CI	Approved Plan	Approve Study Plan and Alternative Screening Criteria	8	1-3 wks
10		Identify Data Needs/Collect Screening Data	AoA Lead Agency/PM	Data Collection to support Alternative Screening and AoA Assessment	If required	9	1-3 mo
11		Technology market research / AoA RFI	PEO/PMs	Range of candidates and data (characteristic/cost/performance etc.) for use in the AoA	Some candidates may be provided in the guidance document, but most often the Study team is tasked with developing potential candidates to be evaluated.	4,10	1-3 mo
12		Screening Analysis	TRAC/AMSAA	Screens AoA alternatives to feasible set to consider in the AoA	Screening criteria is approved at the study plan SAG	9,11	1-3 mo
13		SAG IPR 2	DCAPE/DAMO-CI	Approval of Alternatives, provide guidance to Study Team	Candidates that fail screening may be retained in the analysis as special interest items from the SAG members	12	1-3 wks
14		Performance Data Development	AMSAA	Develops technical data to represent the AoA alternatives	The earlier developed the better.	8,13	3-9 mo
15		Method/Model/Tool (MMT) Development	TRAC/AMSAA	Adjusts existing MMT for AoA use, create new tools for the AoA, refine methods for AoA	Should contribute to an AoA RFI	0,9	1-6 mo
16		Scenario Development	TRAC	Adjusts existing scenarios for the AoA, develops new vignettes and scenarios as needed		0,9	1-6 mo

Figure F-10. ACAT I AoA Process Activities (1 of 3).

INDEX	Input	Activity	Lead Agency	Output	Comments	Predecessor	Duration
17		Cost Data Development	DASA-CE/TRAC	Define cost analysis rules and data development rules for consistency across AoA Alternatives	Should contribute to an AoA RFI	0,9	3-6 mo
18		Operational Data Development	TRAC/Proponent CoE/TCM	Refine existing operational concepts/TTP or develop representation of future operational concepts/TTP in MMT		0,9	1-3 mo
19		Performance Analysis	AMSAA	Item level analysis		14,15	3-9 mo
20		Operational Benefit Analysis	TRAC	Operational and Tactical benefits of Alternatives with associated risks		14,15	3-18 mo
21		Industrial Base Assessment	AMRDEC	Assessment of existing technology and the industrial base's ability to support each alternative	This is an optional study area -- contingent on approved study guidance	9,13	1-6 mo
22		SAG IPR 3	DCAPE/DAMO-CI	Review Results and Provide guidance to Study Team	Should be event driven. Could have more than performance and Ops analysis complete. Should include a TRADES plan or another IPR SAG to approve trades. New work could be directed by the SAG	19,20	1-3 wks
23		Life Cycle Cost Analysis	DASA-CE/TRAC	Fully Burdened cost of Ownership of the AoA Alternatives		13, 17	6-12 mo
24		Schedule Risk Assessment	AMSAA	Evaluation of the proposed Acquisition schedules and associated risk, Evaluation of technology maturity and associated risks of the alternatives	Schedule Risk analysis and Technical Risk analysis are now combined under Schedule Risk analysis.	9,13	3-6 mo
25		Performance Risk Assessment	AMSAA	Risk of each alternative achieving proposed level of performance		19,20	3-6 mo
26		Trades Analysis	TRAC/AMSAA	Modified Alternatives to mitigate the cost/schedule/performance/operational risks		19,20,23,24,25	1-3 mo
27		Fully Burdened Cost of Energy Analysis	DASA-CE/TRAC/AMSAA	Energy consumption and Energy costs for Alternatives		14,18,20,26	1-3 mo
28		Sustainment/Reliability Analysis	TRAC/AMSAA	Sustainment, Reliability, maintenance manpower comparisons of Alternatives		9,14,15	1-6 mo
29		Affordability Analysis	G-8	Comparison of Alternatives Portfolio Affordability		23,26	1-3 mo
30		SAG IPR 4	DCAPE/DAMO-CI	Final Results SAG	Determine that all study issues have been addressed or issue new guidance to study team for additional analysis	23,24,25,26,27,28,29	1-3 wks
31		Analysis Integration	AoA Lead Agency/Study Team	Integrating all analysis into an integrated package to discuss cost/effectiveness/risks/ and trades		30	1-3 mo

Figure F-11. ACAT I AoA Process Activities (2 of 3).

INDEX	Input	Activity	Lead Agency	Output	Comments	Predecessor	Duration
32		Develop Report	AoA Lead Agency	Formal Documentation of all works into an Executive Summary, Report, and supporting appendices/annexes		30	1-3 mo
33		Deliver Report to TRADOC HQ for Staffing	When TRAC is Lead Agency	Review for Leadership approval to provide to HQDA		32	1-3 wks
34		Deliver Report To HQDA for Staffing	AoA Lead Agency	Review for Leadership approval to provide to DCAPE or conduct sufficiency review if at HQDA level		33	1-3 mo
35		Deliver Report to DCAPE for Staffing	DAMO-CI	Review for sufficiency and advise to MDA	If required	34	1-3 mo
36		Sufficiency Review	OSD CAPE / HQDA	Formal memo documenting sufficiency (30 days prior to milestone decision)		34 or 35	1-6 mo
37		AROC/JROC review	DAMO-CI/G-8	Informational review wrt how did the analysis support requirements changes/adjustments		36	1 wk
38		ASARC/DAB	DAE/AEE	Decision to continue to next Milestone phase of the Acquisition process		37	1-3 wks

Figure F-12. ACAT I AoA Process Activities (3 of 3).

F-10 ACAT III Analysis Process

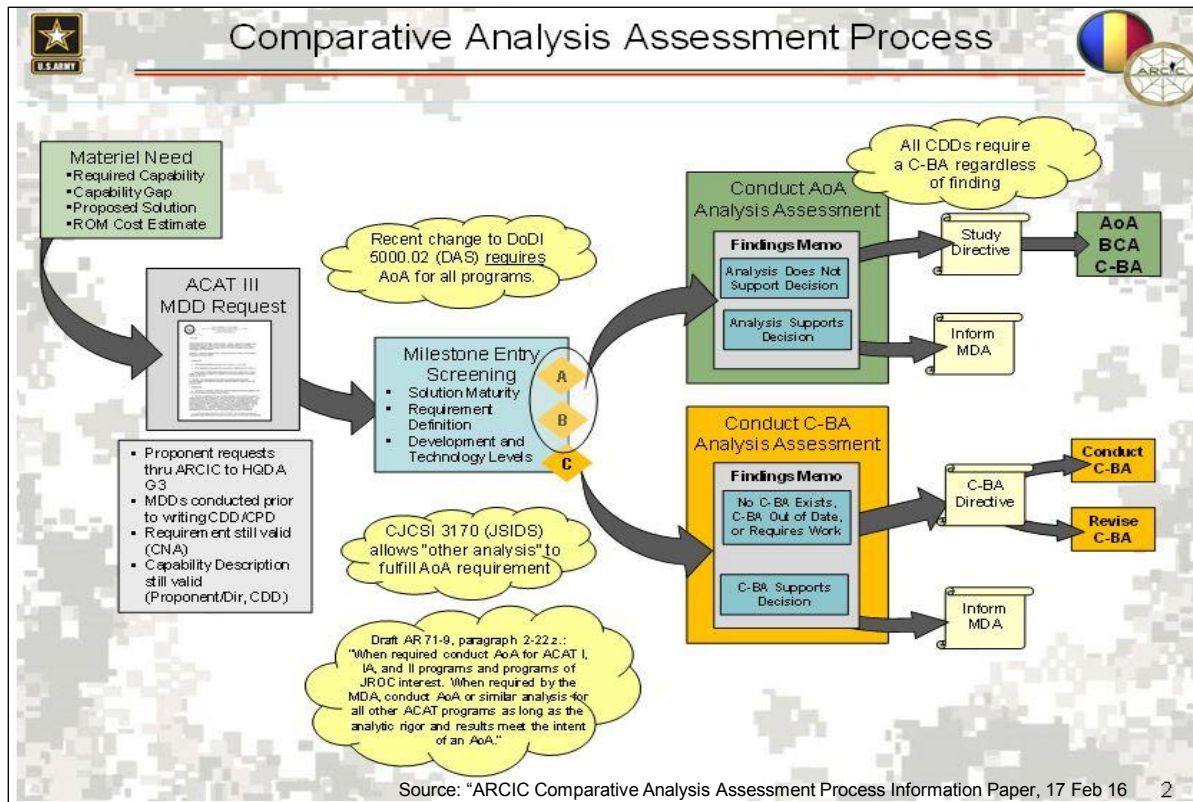


Figure F-13. ACAT III Analysis Process.

ARCIC Studies and Analyses Division (S&AD) is designated as the ARCIC Director's executive agent for proponent Cost Benefit Analysis review and quality assurance.

TRADOC will meet the spirit of regulatory requirements regarding analysis by determining and directing the appropriate level of alternative comparison, or comparative analysis, for every requirement and potential program for which TRADOC is delegated analysis oversight responsibilities.

TRADOC will interpret the regulatory analytic requirement as, "Every acquisition program requires an appropriate level of comparative analysis," for ACAT III designated programs. This may be an AoA, Business Case Analysis, Cost Benefit Analysis, or some other appropriate defensible analysis.

ARCIC S&AD, in concert with TRAC and DASA-CE, developed the ARCIC Comparative Analysis Assessment Process (see Figure above) designed to determine and / or direct the appropriate level of analysis: to foster early standards engagement; to ensure the analysis is focused appropriately to address necessary requirements development; and to meet MDA-defined data needs at program acquisition decision points. This process is designed to reduce the volume of re-work required to deliver defensible analysis.

TRADOC organizations will engage S&AD as early as practical in their requirement development process to support an early determination of the required type of analysis to support their topic specific requirement. S&AD will also assist proponents with developing defensible

analysis that supports Capability Developer requirement refinement, and to inform the MDA at the MDD, and later Milestone Decisions.

INFORMATION PAPER

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SUBJECT: ARCIC Comparative Analysis Assessment Matrix

1. Purpose. Communicate ARCIC's Comparative Analysis Assessment Matrix application.

2. References:

- a. USC Title 10, Section 2366a: Major Defense Acquisition Program: Certification Required Before Milestone 'A' Approval
- b. DoDI 5000.02 Subject: Operation of the Defense Acquisition System (7 JAN 15)
- c. Manual for the Operation of the Joint Capabilities Integration and Development System (JCIDS) (12 FEB 15)
- d. Army Regulation 70-1 Army Acquisition Policy (Research, Development, and Acquisition) (22 JUL 11)
- e. Army Regulation 71-9 Warfighting Capabilities Determination (Force Development) (28 DEC 09)
- f. TRADOC Regulation 71-20: Concept Development, Capabilities Determination, and Capabilities Integration (Force Development) (28 JUN 13)

3. Facts.

- a. An Analysis of Alternatives (AoA) is a statutory requirement for ACAT I programs and is a regulatory requirement for ACAT II and III programs that mirrors statutes.
- b. The AoA fundamentally has two specific purposes: to provide combat developers (CAPDEVs) with defensible analytic evidence identifying the preferred set of system attributes that mitigate identified capability gaps, while still meeting DA derived affordability goals; and, to inform the acquisition Milestone Decision Authority (MDA).
- c. TRADOC and ASA(ALT) coordinated legal reviews confirmed that there is no language in any U.S. Army or DoD regulation that addresses an AoA waiver option, or waiver authority, for ACAT II or III potential programs.
- d. On 30 DEC 09, the VCSA and USA, directed that any unfunded requirement and new or expanded program proposals be accompanied by a thorough Cost-Benefit Analysis (C-BA). A 27 DEC 10 SECDEF directive further stipulated that any new proposal or initiative . . . come with a cost estimate.

3. Background.

- a. TR 71-20 (28 JUN 13) "*Force Development - Concept Development, Capabilities Determination, and Capabilities Integration*" Section 2-10. Dir, ARCIC, para b.

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SUBJECT: ARCIC Comparative Analysis Assessment Process

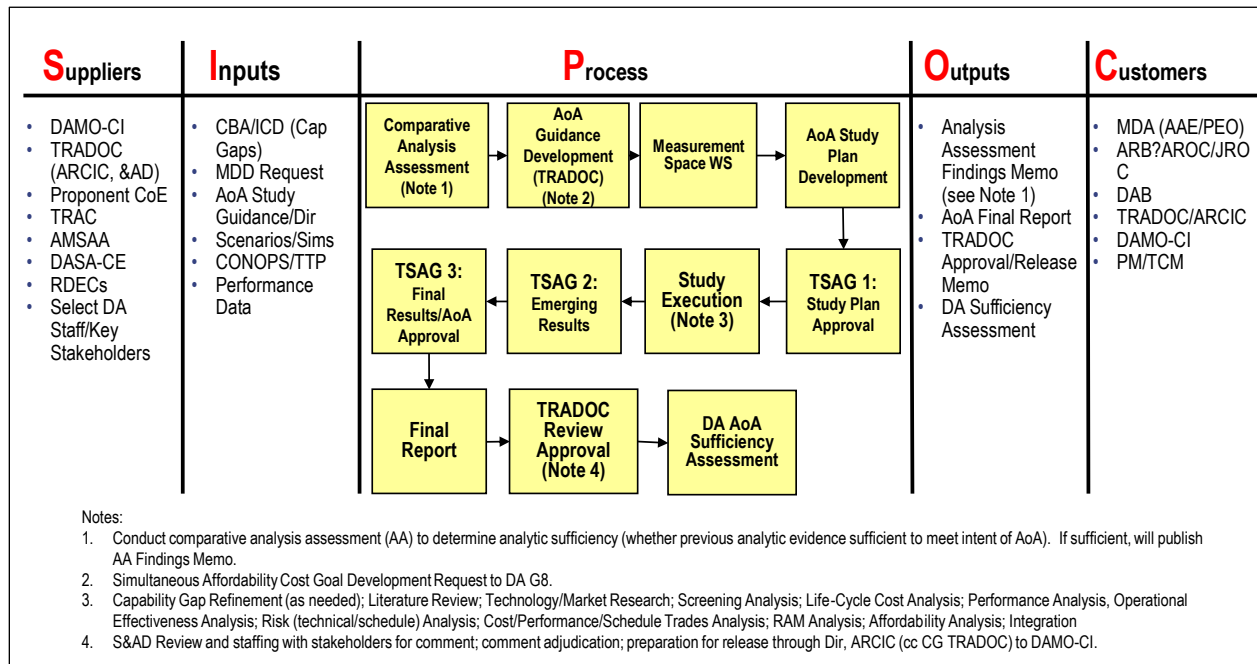
16 FEB 16

"Approve cost-benefit analyses (C-BA) conducted by force modernization proponents."

- b. ARCIC Studies and Analyses Division is designated as the ARCIC Director's executive agent for proponent C-BA review and quality assurance.
 - c. TRADOC will meet the spirit of regulatory requirements regarding analysis by determining and directing the appropriate level of alternative comparison, or comparative analysis, for every requirement and potential program for which TRADOC is delegated analysis oversight responsibilities.
 - d. TRADOC will interpret the regulatory analytic requirement as, "Every acquisition program requires an appropriate level of comparative analysis," for ACAT III designated programs. This may be an Analysis of Alternatives, Business Case Analysis, Cost Benefit Analysis, or some other appropriate defensible analysis.
 - e. S&AD, in concert with TRAC and DASA-CE, developed the ARCIC Comparative Analysis Assessment Process (see Figure below) designed to determine and / or direct the appropriate level of analysis: to foster early standards engagement; to ensure the analysis is focused appropriately to address necessary requirements development; and to meet MDA-defined data needs at program acquisition decision points. This process is designed to reduce the volume of re-work required to deliver defensible analysis.
4. Way Ahead: TRADOC organizations will engage S&AD as early as practical in their requirement development process to support an early determination of the required type of analysis to support their topic specific requirement. S&AD will also assist proponents with developing defensible analysis that supports CAPDEV requirement refinement, and to inform the Milestone Decision Authority (MDA) at the Materiel Development Decision (MDD), and later Milestone Decisions.

PREPARED BY: COL Thomas Dillingham / S&AD / 501-5312

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F-11 ACAT III AoA Process Activities**Figure F-14. ACAT III AoA Process Activities.**

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APPENDIX G SAG EXECUTIVE SUMMARIES

- Funding: an assumption will be that the Army will require \$10M in funding for AoAs in perpetuity. (Note: TRAC points out that it can be more like \$20M, but they have accomplished using mission funding.) Delays in distributing AoA funding has not only led to delays in accomplishing AoAs, but has resulted in under-execution and marks taken. The solution will be to de-link AoA funding from AoA prioritization and to provide dedicated funding to TRAC and AMSAA. Funding can be shifted between performers as needed. Need to work with FM&C to work the rapid funding for FY16.
- LTG Murray's original question was how to shorten the AoA timeline; all of the participants agreed that the problem statement needs to be revised. The study should encompass ACAT I as well as ACAT II & III AoAs, acknowledging the differences between the statutory requirements for ACAT I and the regulatory requirements for ACAT II & III. The Army's needs are different from CAPE's for ACAT I programs.
- The study must look at improving the SAG process with the first SAG used to narrow down the requirements. Need up-front mission analysis and up-front Senior Leader guidance from both Army and OSD leadership – before proceeding on the AoA. Number of alternatives and additional tasks added throughout AoA process drive the scope and timeline.
- The study should include the CSA/VCSA expectations and requirements from the AoA process. What is the value of the AoA?
- Case studies selected need to reflect the full spectrum of AoAs: TRAC-led, AMSAA-led, ACAT-level, etc.
- Which programs were successfully fielded and did the AoA help? Which programs were cancelled and what can we learn from those AoAs?

Figure G-1. Executive Summary Review from 25 March.

- Funding:
 - DAMO-CI wants to clarify the governance process guiding the use of AoA funds and desires a quarterly 1- or 2-Star level AROC to review expenditures to date and discussion of the way ahead; others (TRAC, AMSAA, ASA(ALT) etc.) want to simply address funding at the monthly prioritization Council of Colonels, with any issues brought to the 1- or 2-Star level as needed, but they also said they will support whatever is necessary to get the funding sorted.
 - DASA-CE suggested having a plan in July to defend the next year's \$10M budget to Congress.
 - Noted that all AoA funding would not go to TRAC and AMSAA; most would, but some would go to others (ARL, SLAD, etc.). All concurred with an offline meeting to determine how to split funds prior to the meeting with Mr. Daniels.
- Other Discussion from EXSUM slide:
 - The study should take on the question of how the Army's needs are different when from CAPE. The JROC is an outbrief of AoA results (i.e., an information briefing); the AROC is a decision briefing informed by the AoA results (and other factors). CAPE is looking for an exploration of the trade-space while the components will be looking at cross-trades.
 - Noted that the SAG does not narrow down requirements (as stated on the EXSUM slide), it confirms scenarios, study issues, and proposed alternatives.
 - CAA noted that determining the CSA/VCSA expectations for AoAs will likely require aid from LTG Murray and Mr. Bechtel.
 - ARCIC noted that ACAT III AoAs are rare.
- Problem statement:
 - In general, the group preferred Problem Statement 2, but wanted to keep elements from Statement 1 as objectives in the study.
 - Problem Statement 2 should be edited to read "that satisfy decision-makers' critical information requirements" instead of "that satisfy critical decision-makers' information requirements".
 - Emphasis on making AoAs more effective, not just faster.
 - A question was raised whether we should place in context how the Army does AoAs vice the other Services. CAPE studied this in 2013 and will share their study.
 - Need to accurately define the purpose of an AoA; is it to determine critical attributes and inform requirements development, or to aid in acquisition decisions? DoDI 5000.02 and 31-70 JCIDS document can help.
 - PAE suggested that we add definitions. What are we expecting to come into an AoA, are we presently doing that? We need to neck down and lay out what the expectations are all along the way in the process.
 - Need to also identify what we're expecting to be done pre-AoA.

Figure G-2. Executive Summary from 29 March (1 of 2).

- Purpose and Objectives:
 - Participants will send new ideas based on this meeting's discussions.
 - Study should include pre-AoA activities.
- Literature Review:
 - Should be sorted by the level of the decision maker that can effect a change (i.e., Congress, OSD, Army, etc.); additionally, there should be an assumption of what we can or can't change (e.g., public law won't change)
 - Also include CBA study and CAPE study.
- Scope:
 - Noted that prioritization is the priority of AoAs relative to one another; the AROC is how the senior leaders bless this prioritization.
 - Don't talk just about how the AROC was in the past, but how it could/should be.
 - Identify who is the customer of the AoA – Acquisition Decision Authority? JROC? Congress?
 - Should we put time and resources towards items that don't distinguish between alternatives?
 - For case studies, "good" and "bad" are subjective terms; instead say process elements that were good or those that were challenges. DASA-CE volunteered to provide some case studies with cost-related challenges.
 - For case studies, there are AARs from the AoAs that can help.
 - Have to define timeline; large parts of the overall AoA timeline are guidance development before the analysis and closeout work after the analysis (e.g., admin., getting signatures, etc.). Some parts we control, some we don't.
 - How should AoA Study Guidance be developed? Guidance development is where things are sometimes added just because they're nice to have, not because they actually distinguish between alternatives; treated as staffing action. These add-ons can increase the number of alternatives and extend timelines.
 - How do we define when the AoA starts and is complete? CI suggested that AoA begins at the start of the 1st SAG; The end is driven when the DAB is scheduled. CAPE: Final SAG briefs do not always embody what is eventually sent to CAPE.
- Recommendations: The Decker-Wagner paper recommended requirements improvements; nothing has been done yet.

Figure G-3. Executive Summary from 29 March (2 of 2).

- Additional interview recommendations suggested: someone from ASA(ALT), especially MG Thurgood and the ASA(ALT); Dr. Baker (director of SLAD) or Mr. Bowen; Mr. Amato; Mr. Cook (AEC). Members will help to set up interviews as appropriate.
- Recommended removing Crusader from the case study list, as the AoA was never actually completed before the program was cancelled.
- Process map:
 - Be sure to include the MDD request (after ICD need, before developing study guidance); this is a G-8 function that initiates the analytic efforts to prepare for the MDD. It identifies the lead agency for the AoA and prompts them to start writing the study guidance and study plan. It indicates an interest in a materiel solution, though the MDD is when the MDA actually decides whether or not the Army will pursue a materiel solution. The ASARC is the body that reviews the material and makes the MDD request (DAB for Joint Systems).
 - ACAT III programs don't always require all the steps that ACAT I or II programs do, largely because they often enter the acquisition process pre-MS B or pre-MS C (e.g., the technology may already be mature). Therefore, the first step for an ACAT III AoA is to look at any existing analysis and see if that satisfies the AoA needs. Existing analysis can include analysis from Technology Demonstrations and operational assessments from equipment used in theater, etc.
 - Resources are limited, so leadership should identify what's most important.
 - TRADOC does capability needs assessment (CNA), which assesses the needs of the whole Army, not specific systems. They don't have the resources to do systems-level requirements analysis on their own for all systems; maybe the CoEs or RDECs can help with that? Currently there are some system-level analyses, but they're at a higher level and more qualitative.
 - Does the Army have enough resources for detailed, quantitative pre-AoA analysis? The CoEs are trying to do this, previously had limited analytical resources but getting better, but aren't quite there yet. ARL/RDECs are also starting to get into the process earlier, which may help. Again, with limited resources would need to prioritize pre-AoA analytical activities.
 - What is the timeframe for the various steps in the process map? If there are delays, what causes them? Who receives the various outputs/products, and how do they use them? The long poles in the timeline are 1) performance data development, 2) model development, especially combat models & scenario development and 3) life cycle cost analysis. In all three, the amount of knowledge going in to the process is what dictates how long it will take (e.g., are most of the technologies well-known, or are they new, meaning we don't have existing data and models to rely on; requirement to use new emerging scenarios; requirement for model modifications to replicate new concepts and behaviors). How much have we invested in the previous FY in data and model development?

Figure G-4. Executive Summary from 8 April.

- Challenges/recommendations to LTG Murray can be grouped into three areas:
 - 1) Pre-AoA Concepts and Decisions.
 - a) The AoA is burdened by "immature" ICDs. The AoA must then refine capability gaps, requirements, and concepts of employment. This cannot be fixed with existing resources in TRADOC.
 - b) Army leadership does not inform scope of the AoA.
 - Recommendation: The AROC that reviews the ICD must be a decision making forum that isolates concepts for refinement and the scope of the AoA. The AROCM must codify the decisions to constrain the AoA's scope.
 - 2) Pre-AoA Data, Models, and Simulations. For developmental systems, the Army must develop data, scenarios and M&S to support analyses. When these do not exist, a forecast of the analysis requirements is imperative.
 - Recommendation: Some forum must validate the AoA forecast for the analysis community.
 - 3) AoA Process. Staff friction, sequential reviews, and mission creep cause delays (especially as SAGs don't always have the same people present, so issues are brought up again after already being decided).
 - Recommendation: Employ central coordination of AoAs that are planned and in progress. For all decision-making forums (AROCs and SAGs), codify those decisions to prevent mission creep. Allow parallel reviews in TRADOC, HQDA, and CAPE.
- For the background information, cite legal requirements (e.g., WSARA). (Dr. Markowitz)
- CI currently "tracks" the in-progress and planned AoAs. They report those biannually at the SAR and periodically with TRAC and AMSAA. That might not be sufficient to support #2 and #3, above. CI expressed that ASA(ALT) might need to weigh more heavily on that. (COL Seaward)

Figure G-5. Executive Summary from 12 April (1 of 2).

- Challenge #1 must address the "level" of analysis. Some programs are more complex and/or more important than others. (We capture importance via the ACAT level.) Prior to the AoA, the scoping effort should reflect the complexity and importance of the program in question. (MG Dyess)
- Comment from Dr. Markowitz: We need to get VCSA guidance sooner. (Hence, challenge 1b.)
- Comment from MG Richardson (paraphrased): I just sat in an AROC. There was no mention of the AoA. The VCSA is not being given the chance to influence. (Again, challenge 1b).
- The ICD should have an analytical annex; the requirements need rationales to properly define the tradespace.
- Need prioritization of capability gaps and requirements.
- There is an analytical gap between the CNA and the MDD request, and we don't necessarily have the resources to do this analysis.
- Congress has shown more interest recently in seeing AoAs.
- The timeline of the AoA is only a problem if it delays/holds up the decision or the DAB. An AoA has never delayed a DAB.
- Resources/workforce of the analytic community is a problem; TRAC currently has sufficient resources, but might not in the future as the workforce is cut and workload increases. ARCIC's manpower to do pre-AoA analysis is already not enough (and especially not trained enough). AMSAA's is at bare bones now and has targeted personnel reductions. DAMO-CI indicated that their projection for the workload in late 16/FY17 will go up significantly. We might be able to take past history data to get a range of past analytical capacity in order to forecast future resources, which will be something less unless something changes.
- Issues in getting required data, especially foreign data or in post MS A updates, where there's conflict with acquisition regulations and the ability to get data from contractors. Also, do we have access to the right information for pre-AoA analysis?

Figure G-6. Executive Summary from 12 April (2 of 2).

APPENDIX H ARMY AOA REVIEW

H-1 Army AoA Duration

The average AoA duration for the last 10 Army AoAs was ~13 months, with another 2 to 4 months for staffing and “sufficiency” determination depending on whether the program had Army or OSD oversight.

H-2 Recent Army AoAs with CAPE Oversight

Armored Multi-Purpose Vehicle (AMPV) (TRADOC-led), ACAT 1D. Short duration study - high quality/detailed final report. All options proceed to Engineering and Manufacturing Development Phase (EMD) with Government Furnished Equipment (GFE) Hulls (some pure or mixed fleets). However, system subsequently failed its Preliminary Design Review (PDR); additional time might have allowed for the AoA Study Team to conduct additional independent requirements/performance analysis to foresee this challenge.

Lower Tier Air and Missile Defense Capability (LTAMDC) (TRADOC-Led), ACAT 1D. CAPE refused to schedule a SAG in August (too busy with Program Review). CAPE added a late requirement to review additional classified analysis on performance against an advanced threat not included in the study guidance. Delay in alternative approval by SAG. Screening SAG, originally conducted as paper SAG, did not receive OSD concurrence. Screening was re-presented during the next face-face SAG. Alternatives were not finalized until analysis had been completed. 4-star TRADOC Staffing of final report. MDD conducted 12 December 2014.

Long-Range Precision Fires (LRPF) (TRADOC-led), ACAT 1D. DAE expanded scope at the MDD by adding requirement to address In-flight Target Update (IFTU) and Seeker. The office of the Assistant Secretary of Defense for Research and Engineering (ASD(R&E)) requested addition of a new warhead alternative during the study that was not competitive but required effort to address (Kinetic Energy Projectile). CAPE provided additional/clarifying guidance during the study that restricted the ability of the Army to model (or even represent the effects of) low observable aircraft in the study (delayed completion of operational effectiveness analysis). CAPE added a requirement to address consideration of classified National Intelligence, Surveillance, and Reconnaissance (ISR) assets (not included in original guidance). 4-star TRADOC staffing of final report.

Improved Turbine Engine Program (ITEP) (TRADOC-led), ACAT 1D, Pre-MS A AoA. Performance, Risk, Cost, Affordability were the most useful components. Study showed benefits/weaknesses of all alternatives. OSD recommended Alt 2; Headquarters, Department of the Army (HQDA) selected Alt 4. ITEP New Start had been advertised as a Win-Win with respect to Performance and Lower Cost. Study showed that the New Start produced greater Performance with greater Cost. Risk analysis recommended changes to the PM schedule (which were accepted). Affordability analysis showed issues with funding. HQDA changed priorities to increase ITEP funding. Sustainment and reliability analysis was hampered with minimal data for a pre-MS A system. Differences between the alternatives were not operationally significant. Changes in force structure were not considered. Delay in Army completion of Life Cycle Cost Estimates impacted study completion (~3 months).

Joint Air-to-Ground Missile (JAGM) Increment I Update (TRADOC-led), ACAT 1D. The initial intent in Defense Acquisition Executive (DAE) Acquisition Decision Memorandum (ADM) and CAPE Guidance was to update Life Cycle Costs. CAPE required more performance analysis than anticipated. CAPE required the Army to include a foreign alternative for which the Army was unable to obtain detailed data. After significant effort to obtain performance data on the foreign system, the Army eventually surrogated the performance (incurring some risk of misrepresenting performance).

Indirect Fire Protection Capability IFPC) Increment 2 (TRADOC-led), ACAT 1C. Near the end of the study, CAPE directed a follow-on excursion to address an additional threat, requiring 2 additional months to complete.

Ground Combat Vehicle (GCV) (TRADOC-led), ACAT 1C. A high quality/detailed MS A final report that enabled subsequent Army senior leader decisions for this system. AoA helped inform deferred investment decision and S&T work.

H-3 Recent Army AoAs with Army Oversight

Brownout Rotor Craft Enhancement System (BORES) (AMSAA-led), ACAT II. Planned as MS A Decision AoA, the program was unfunded so the AoA continued with zero affordability. Significant initial delay in getting to MDD (ASA(ALT) adjusted the scope of the program from ACAT I Degraded Visual Environment (DVE) Solution to ACAT II BORES) and starting the study later, after the MDD, to allow HQDA to refine the study guidance. However, the Army completed the study nearly on schedule; the affordability goal was \$0 since the system was not funded in the POM; subsequently, the Army has funded this system.

H-47 Block II (AMSAA-led), ACAT 1C. No significant issues - The Army completed the study on schedule in accordance with the (originally issued) CAPE Guidance and HQDA Directive. DAE delegated MDA to Army during the study, and CAPE later relinquished oversight of the AoA. AoA supported Request for Proposal (RFP) release in 2Q FY 2016 in support of a MS B in 2Q FY 2017. Cost and Affordability received the most attention at the Army Systems Acquisition Review Council (ASARC) and were the most useful components of the AoA. Production rates below 12 were found to be unsustainable.

Biometric Enabling Capability (BEC) Increment 1 AoA Update (AMSAA-led), ACAT 1A. Study was conducted to support an Acquisition strategy path forward and to inform a cost effective, preferred alternative decision by the AAE. Near the end of the study, emergent results revealed that all alternatives under consideration were unaffordable. HQDA added additional alternatives for analysis that extended the study by 3 months but produced a selection of affordable choices.

H-4 Key Pre-MDD Activities

Front End Analysis (literature research, review and prioritize gaps, identify and define potential alternative candidates, and attribute development).

Measurement Space Workshop (Identify metrics, define environmental and operational conditions, threat and scenario/vignettes, methods, models, and tools.

Material Development Decision (MDD) Brief Development.

Develop Army input for OSD CAPE Study Guidance.

OSD CAPE issues' Study Guidance / HQDA issues' Study Directive.

Study Plan Development.

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